TENSIONS AND TECHNOLOGY SERIES

EDUCATION IN A TECHNOLOGICAL SOCIETY

UNESCO

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A Preliminary International Survey
of the Nature and Efficacy
of Technical Education

UNESCO

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FOREWORD

Unesco's 1950 Programme included a resolution authorizing enquiries into "the influence of modern technology upon the attitudes and mutual relationships of peoples". The 1951 Programme authorized "the study of methods employed in Member States for developing their educational systems to meet their technological needs".

An international conference of experts, which met at Unesco House in June 1950, proposed certain broad lines of action to this end. These proposals are set forth in summary form in the Introduction to the present Report, and in greater detail in the subsequent chapters. The data presented and the opinions expressed do not commit Unesco in any fashion but represent the background material upon which the Conference's findings were based. They are in no way conclusive or complete.

In the final chapter a series of questions, growing out of the experts' findings, is addressed to Unesco Member States. The replies to these questions will, if appropriate, form the basis of a Report to be laid before the Executive Board and the Unesco General Conference for action.

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I. In an age when mankind's potentialities for destruction have been enormously enhanced by such discoveries as that of atomic power, the most pressing human problem might appear to be: how can man exist? For many, however, there is another, perhaps even more important and not unrelated to the first: in a technological age such as ours, how can man more truly *live*? And the answer to this second problem is to be found largely in the field of education.

To try to provide an answer to this fundamental question without an appreciation of some of the outstanding changes which have taken place both in education and technology during the past 50 years would be unrealistic and impractical; for the nature of the changes is such as to demand a complete reorientation of our thoughts regarding the task of education today.

The quantitative and qualitative changes in education have often been described, but their gradual and cumulative nature may obscure their real impact. Quantitatively, more children are receiving education at the elementary, secondary and advanced levels than ever in the past. Qualitatively, an attempt, possibly more direct in education than in any other sphere of activity, is being made to work towards real equality of opportunity for all groups of society. The cumulative and gradual changes taking place in technology may often not be obvious; and they may be taking place at a very different speed and in a widely different direction from those in education. They have taken the form, on the one hand, of an ever more rapid introduction of modern technology into every corner of the earth; and, on the other, of the rapid transformation of technical methods, due partly to invention and partly to economic and political fluctuations. Whereas of old a man learning a trade could count himself equipped for a lifetime, and was encouraged by the stability of the times to arrange a comparable or identical training for his sons, today some new industrial process or politico-economic development may enforce repeated changes of occupation within the space of a few years.

Once seen in perspective, the effect of these changes in education and technology becomes clear. As long as a country educates only a small

proportion of its children, and that during the earliest years only, the instruction given can hardly fail to be more or less useful. But if—to take an extreme case—a country educates almost all its young people up to the age of 16 or 18, it is most important that the education given, particularly in the later years, shall be appropriate. Otherwise, large numbers may be prepared for a type of life which they will not be able to lead. That they may wish to receive inappropriate instruction, and that the educational system meets this wish, in no way serves to set the matter right. If, for instance, in a country largely dependent upon the mining of coal or the growing of wheat the great mass of the coming generation prefers to be educated to become small clerks or shopkeepers or poets, that country will be in grave danger of wrecking itself upon the reef of its excellent intentions. It would be educating for the good life—as each separate individual understands it—but failing to secure the material basis upon which such a life depends.

In short, so long as relatively few children in a country are educated beyond the elementary standard, it is altogether suitable that education should be "pupil-centred", i.e. that its object should be simply and solely to develop the aptitudes of a particular boy or girl. But as soon as considerable numbers are carried beyond the elementary standard, a further principle must be introduced. The educational system needs to be "community-structured", i.e. so designed as to take due account of the means by which the country exists and prospers.

Such "community-structuring" of the educational system is, moreover, in the best interests of the pupils themselves, individually as well as collectively. This becomes evident as soon as changes in technology are taken into account. In the course of the next 50 years—the lifetime of the children now in the schools—there can be little question that the spread of technology to all peoples will have changed the whole aspect of the world. There can be little question also that the rate of tranformation in technical methods will not have diminished. In these circumstances, unless education is "community-structured" with an eye to the future, it will be bad education. There can be few things more disastrous, for individuals no less than for a people as a whole, than that they should be educated for a way of life that does not exist.

It is at this point that the essentially international aspect of the question must be taken into consideration. In building their educational systems round the needs of the community, the peoples of the world have everything to gain in learning from one another. Those countries in the process of industrial development can profit greatly from both the successes and the mistakes of the countries with longer technological experience. Even the highly advanced countries can see their own problems, and the possible solutions, in better perspective against the background of experience other than their own.

In yet another way, international co-operation in this field has its special cogency. Failure on the part of education to meet the challenge of a technological way of life has consequences which do not stop short at frontiers. A country which makes no adequate provision for preparing its young people for the life they will actually lead, giving them instead an education based upon a conception of society long since past, is likely to expose them to great psychological, social and economic tensions. The *déclassé* intellectual, forced into work which he regards as beneath him or making a dubious living by his wits, the unskilled worker who feels himself exploited, the countryman (with no special aptitude for anything else) for whom "*la terre est trop basse*", are typical products of educational inadequacy or misdirection. At the other end of the scale, a country whose concept of education in a technological society is to create slaves to mind its machines, is not only committing a crime against humanity; it is a source of danger to the peoples around it. The international character of the problem is thus to be seen not only in the search for solutions by means of the comparative method, but still more in the world conseqences if solutions are not found and applied.

II. With these considerations particularly in mind, in June 1950 Unesco called an Expert Conference on Educational Systems and Modern Technology.

Experts from 12 Member States attended the Conference, these experts being selected on the advice of the Unesco National Commissions for the countries concerned. In addition, two small working paties—one of social scientists, the other of statisticians—were attached to the Conference. While the countries represented were for the most part highly industrialized—since it was felt that the Conference could best build upon their long experience—experts from three countries in process of industrialization—India, Brazil and Turkey, also took active part. After mature consideration it was decided not to include the so-called under-developed peoples within the scope of the Conference, since the problems there took on too many new forms to be handled in a single meeting. Although it was fully recognized that the conclusions reached bore upon the situation of the under-developed areas, it was agreed that they would require extensive modifications before they could be considered applicable to conditions therein. Observers from the United Nations and the International Labour Office attended the Conference and greatly assisted it in its work. [1]

From papers prepared by the experts previous to the Conference, four main points clearly emerged. Taken as a whole the consensus of opinion and experience was that with certain notable exceptions:

[1] For list of participants, see Appendix A.

(1) The technical education at present given is wholly inadequate to future needs.
(2) The general education given is lacking in the realistic, contemporary knowledge necessary for life in a technological society and inclines towards a bookish "know about" rather than a practical "know how".
(3) The cultural content of technical education is inadequate.
(4) Technical education (including apprenticeship and other forms of in-industry training) is liable to be too narrow in a world of rapid technological change.

The Conference set itself to propose ways and means of removing these difficulties; not by adapting man to the technological society but rather by considering how education can form the "whole man"—that is, the man who is capable of living in a technological society and of tranforming it to meet the material and spiritual needs of the age.

III. The Conference cast its findings in a series of proposals which, it considered, might form the basis of an International Recommendation under Article IV(4) of the Unesco Constitution. It did not attempt to phrase these proposals in formal language, but confined itself to suggesting what the substance of each might be.

In the view of the Conference, Article I of the Recommendation should deal with the need for social foresight with regard to this question. It would lay down the general principle that, in order to judge how many and what kind of technical schools and institutes should be established, regular statistical estimates are needed of a country's requirements in trained personnel for the major types of work at all levels. These estimates should be local and regional as well as national in their scope. Moreover, as present education is not for the present but for the future needs of society, occupational trends should be continuously forecast as far forward as practicable.

Article II would then proceed to establish the complementary principle that appropriate measures should be taken to set up technical schools and institutes adequate to meet future needs for technically trained personnel. Specific proposals under this head were that:
(1) Technical schools should be designed and equipped so as to be at least as attractive in layout and amenities as those intended for general education.
(2) The staff of such schools should enjoy a status at least as favoured as those engaged in general education.
(3) Every facility should be given to children and young persons attending general schools to switch to technical schools, and vice versa.
(4) Access to institutions of higher learning should be as readily available from technical schools as from general schools.

Article III would turn to the question of the element of "know how" in general education. The principle proposed is that practical instruction of a realistic and contemporary character, appropriate to life in

a technological society, should form an integral part of the curriculum. Specific points stressed by the Conference under this head included:
(1) Encouragement of operations requiring teamwork, so that there should be education for working in groups as well as for work as an individual.
(2) Provision for games, camping and other outdoor activities, preferably in teams.
(3) Teaching aimed at training pupils to find things and do things for themselves.
(4) The provision of workshops and other manipulative forms of learning, conceived not as unimportant accessories which can be dropped when the examination period approaches, but as an essential part of general education.

Under Article IV, the general principle proposed by the Conference was that cultural education should constitute an integral part of the instruction given in technical schools and institutes. Particular emphasis was laid upon:
(1) The primary importance of teacher selection and training to ensure that pupils should be stimulated in the early stages to want to continue their education throughout life.
(2) The need for instruction, carefully integrated with the practical work of the students, bearing upon (a) social and economic questions (such as the history of labour, the development of particular industries, civics, etc.); (b) adequate mastery of the native tongue (and, where appropriate, of other languages); (c) design and other means of providing an adequate basis for appreciation of the arts.
(3) Provision for adult education (including young people) both in the technical and in the cultural fields.

In general, the Conference urged that teaching should aim at developing the personality of the student, together with such a spirit of enquiry and independence of thought as would stand him in good stead not only in his work but in his free-time activities as well.

Article V would take up the problem of making technical training sufficiently supple to meet the needs of a rapidly changing technology. The general principle put forward is that, where part time or whole time technical education is given within industry, instruction should be sufficiently broad to make the subsequent reorientation of young persons possible, should this prove necessary. Measures for securing this essential adaptability include:
(1) The provision of part-time day education, both general and technical, in schools designed for that purpose.
(2) Training in skills common to a number of trades.
(3) Co-operative arrangements within industry enabling the learner to broaden his knowledge by working in different types of undertakings.

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technical and specialized education of girls and women. The principle laid down here was that of parity; the education given to girls and women should be of equal value with that given to boys and men. Such education would include not only technical instruction enabling girls and women to better their economic position but, in view of its immense importance in regard to social tensions, also education for home-making, motherhood and the care and upbringing of children.

Finally, in Article VII, the need would be emphasized for administrative machinery designed to secure modification of the educational system as the technological situation evolved. Emphasis was laid on two points in particular:

(1) The establishment of local and national co-operation (a) between bodies providing various types of technical education; (b) between the various government authorities responsible for education and those responsible for labour and technological matters generally; (c) between the education authorities and industry itself, including both management and workers; (d) between the different schools, etc., and industry.

(2) The setting up where appropriate of a Central Review Agency to examine technological and occupational trends and to consider whether any changes in the nature of education might be desirable in consequence.

The Recommendation would be preceded by a Preamble explaining the need for organized social foresight if education is to help to resolve the tensions inherent in a technological society; indicating the reasons for which such foresight is especially necessary at the present time; recognizing the wide difference in circumstances of the various countries; and drawing attention to the Recommendations of the International Labour Organization in this and allied fields.

IV. The ensuing Report examines each of these proposed Articles in turn, and brings together the data considered by the Conference, which have a bearing upon their implementation. The final chapter contains a number of questions which might be addressed to the Member States of Unesco, together with the amplifications given in the present Report. The replies to these questions could provide the material for a world survey on which an International Recommendation under Article IV(4) of the Unesco Constitution might eventually be based.

CHAPTER I

THE NEED FOR SOCIAL FORESIGHT IN ESTIMATING TECHNOLOGICAL NEEDS AND IN PROVIDING SUITABLE EDUCATION

I. Technology is moving forward the world over at an increasingly rapid pace. If a country's educational system remains static, tensions are bound to be created, particularly amongst those who may have been prepared by their early training for a type of activity which is passing away. In the unanimous view of the Conference those concerned with education must, therefore, exercise an increased measure of social foresight, using the best knowledge available for forecasting technological needs in relation to educational facilities. Otherwise, the establishment of a proper balance between education and occupational opportunity will become increasingly difficult, if not impossible.

Recent developments both in education and in industry have made this forward projection of education of far greater moment than previously. Today, more people are receiving more schooling for a longer period than ever before. For good or evil they are being formed in and by schools to a much greater extent than their predecessors, not only in their aptitudes and skills but in their whole attitude to life. At the same time, in industry, the harsh disciplines of the nineteenth century—unemployment, destitution, even starvation—are being ameliorated by social services and fuller employment. There is no longer any automatic adjustment to economic realities. At a time when occupational flexibility is more than ever necessary, the influences making for it are diminishing in force. All these things indicate that, in its educational system and policy, a country needs to exercise far more wise prevision than ever in the past.

The need for foresight and the encouragement of a greater measure of occupational flexibility is further emphasized by certain major political and economic changes of recent years. Countries which were formerly great colonial powers are now being forced to adjust to new conditions. Countries formerly under tutelage are now self-governing and bearing the weight of their own responsibilities. The disruption of exchanges, balance of payments difficulties, the cutting of the arteries of trade, have all enforced drastic occupational reorientation. In the process of re-adaptation to these changed circumstances, vocational guidance in a number of countries is doing much to help.

The International Labour Organization has been particularly active in this field. Since 1938, for example, it has sponsored a comprehensive programme for the development of employment services, vocational guidance, vocational training and emigration schemes. But if young people are being wrongly shaped by the educational system initially, so that they find only unsuitable or unsatisfying work in industry, vocational guidance alone may be inadequate if not helpless to resolve the tensions so generated. What, then, can be done to guide the steps of those who plan the future educational development of a country, to ensure that a dynamic equilibrium between educational provision and technological needs is achieved and maintained?

II. In considering this problem, the Conference benefited greatly from the work undertaken by its Statistical Committee. The task of this Committee was not to prescribe detailed administrative solutions applicable to the widely varying needs of different countries in different stages of technological development, but rather to indicate in broad outline the pattern of occupational change brought about in those countries where industrialization had already reached a fairly advanced stage, and the extent to which this pattern was likely to influence the future development of the educational system.

In analysing the types of occupation into which a country's economy can be divided, 10 main groups were distinguished as follows:

(1) Agriculture, forestry, hunting and fishing.
(2) Mining and quarrying.
(3) Manufacturing.
(4) Construction.
(5) Electricity, gas, water and sanitary services.
(6) Commerce.
(7) Transport, storage and communication.
(8) (a) Government services (other than armed forces).
    (b) Armed forces: permanent only (temporary conscripts to be excluded from the working population).
(9) Community and business services.
(10) Recreation and personal services.

These 10 groups may be classified broadly under three main headings: "Primary" activities, such as agriculture, mining and related industries; "Secondary" activities, such as the manufacturing industries and construction; "Tertiary" activities, such as personal service, commerce, community and business services and administration.

International comparisons in this field are at best approximate. One obvious difficulty arises from the great differences in the terminology employed, e.g. the definition of what is meant by a "skilled worker" in England, France and Italy. But it is still possible to forecast, with some reasonable degree of accuracy, what will happen to the relationship between the proportion of workers employed in "primary", "second-

ary" and "tertiary" activities in an economy which is expanding on the technological side, and whose productive capacity per worker employed is increasing.

First, expanding industries tend to reduce the percentage of the labour force occupied in the "primary" activity of agriculture (and to some extent also in mining) by absorbing a good deal of the work previously done on farms, both of an agricultural and a non-agricultural character. Spinning, weaving, the making of cloth and household garments for example, are transferred to factories. By producing agricultural machinery and thus assisting the farmer's task, factories also tend to reduce the number of agricultural workers. Further, the use of better agricultural equipment and other improvements raises the output per farm worker; fewer farmers are required to produce the nation's food, and fewer farm hands and labourers are employed. Manufacturing industries show a steady rise in the number of workers employed up to a certain "optimum" point (after which there is relative stability in the numbers employed, or perhaps a slight decline), because they absorb more and more work from other branches of the economy and from the household, and because of the relatively great elasticity in demand for their product. The greatest increase, however, occurs in those "tertiary" activities such as transportation and trade (which expand rapidly to handle the growing amount of goods produced per worker), the entertainment industry, luxury and personal services, and professional services (e.g. lawyers, doctors and dentists), where an expansion is made possible by the rise in real income occasioned by the increasing productivity per worker.

"Tertiary" activities, and the type of educational provision suitable for them, depend on a solid foundation of expanding "primary" and "secondary" activities. Without this expansion of basic productivity, the economic system becomes top-heavy and an educational system designed in the main to meet the needs of "tertiary" occupations may become in practice completely unreal.

The broad trends in occupational change brought about by an increasing development of technology in an industrialized society may be illustrated by the table in Appendix B, which shows the percentage distribution of the labour force by occupation in the United States of America from 1840 to 1940.

Not only, however, is it of value to have some broad idea of the relative change in occupational groupings; it is also important to classify the types of workers employed within these groupings and the types of education which exist to meet present needs and the future pattern of development. Appendix C sets out a sample table of occupational classes in the United States of America and the median number of years of education received by each class, together with a sample classification of different types of school and educational institution under the three headings: Higher, Secondary and Primary.

Similar tables constructed for each country, and supplemented by the statistical data mentioned below (Section III), might be of value not only in the attempt to relate the requirement for workers in the different industries to the educational system of the country and its capacity to produce trained personnel, but also in the far more difficult task of making a general estimate of the future number of workers required in each particular occupational group in relation to the level of education deemed desirable.

III. So far as the calculation of future demand for trained personnel is concerned, the general experience of those present at the Conference was that, except in the Netherlands, the United States and, to a limited extent, the United Kingdom (in the recently published studies by the Ministry of Labour on the demand for various groups of highly-trained technologists), comparatively little large-scale work has yet been attempted. Estimates of this type, moreover, are liable to grave error. In the Netherlands, for instance, where excellent detailed estimates had been made of the numbers of engineers, doctors, clergymen, etc., required over the next 15 to 20 years, the situation changed so rapidly that many of the estimates proved in practice to be somewhat less than accurate. The Conference concluded, accordingly, that the wisest procedure was to suggest not specific methods but certain broad principles of estimation and calculation which might (with suitable variations to meet the widely differing needs of countries) be usefully considered by planning and statistical authorities.

On the demand side, two major factors should be borne in mind: (A) replacement and (B) extension of the occupational group.

A. In considering *replacement*, natural losses from death can be fairly closely predicted from life tables, provided that the census authorities prepare a tabulation of occupations by age (preferably the eight age groups recommended by the United Nations Population Commission and Statistics Office, viz., under 15, 15—19, 20—24, 25—34, 35—44, 45—54, 55—64, 65 and over). In addition, statistics of voluntary or compulsory retirement from active work are of the very greatest importance. It is possible that there will be a *rise* in the age of retirement, whether under compulsory pension schemes (as recently introduced for the United Kingdom Civil Service and for the staff of the French railways), or for those voluntarily retiring. In this connexion, it is noticeable that present economic trends, assisted by the slowing down in the rate of population growth, often tend to diminish the real income of elderly persons, whether dependent on pensions or on their savings. In consequence, numbers of elderly people are compelled to remain at their work—mostly of a clerical nature—after the time at which they would normally have retired. As an example, therefore, this factor must be taken into consideration when estimating the replacement demand for clerical workers.

B. The probable *extension of demand* for specific occupational groups is by no means easy to estimate in any society; it is particularly difficult in a society experiencing the full impact of technological advance. Four stages are suggested for a solution of the problems involved:

(1) The general trends in the economy must be made plain, on the basis of the best statistical information, by those responsible for forecasting population and for preparing a comprehensive economic plan.

(2) The services of the economist should be called into play to arrive at an appraisal of the changes likely to take place in the relative demand for different classes of goods and services.

(3) An analysis should be made of the possible changes in the relative demand for different types of skill within each industry. Particular difficulties occur in respect of supervisory and similar grades. In estimating demand in these grades, it is not safe to assume that the ratio of the number of such positions to the total numbers engaged in the industry will remain unchanged. For example, in an industry which is rapidly becoming mechanized, the number of labourers and unskilled workers soon begins to show a decided decrease; while the number of supervisors, administrators, directors of research and higher staff generally increases even faster. Much useful knowledge can be gained by a country where the process of industrialization has not gone very far, from a comparative study of the data of other countries at a slightly more advanced stage. When planning a programme for the training of engineers, the Netherlands, for example, raised its estimates of the proportion requiring training at the highest level through studying the statistics of Switzerland, where highly skilled precision engineering has been much developed. Similarly, in some trades the study of international statistics may indicate the need for an increased relative number of "operatives" or workers trained in a single limited skill.

(4) In giving a picture of the total needs of a single industry or occupation, some distinction must be made between different types of activity within a general classification: in engineering, for example, some estimate will be required for mechanical, civil, electrical, agricultural, chemical and production engineers, each separately, if the economy is not to be pushed out of balance.

IV. On the side of supply of trained personnel, both "present surplus" and "future output" must be considered. In calculating the "present surplus", statistics of "official" unemployment may require to be supplemented by estimates of "disguised" unemployment—"briefless barristers", unsuccessful small shopkeepers or salesmen, etc. The "future output" may be obtained from an analysis of school and university records. Such an analysis needs to take into account not only those completing the course of study and successfully passing

the examination at the end of it, but also those who fail to complete the course, or who transfer at an early age from one type of educational institution to another. In the case of women, allowance must be made for the fact that often a woman will complete a course of training for a specific full-time or part-time occupation and then choose matrimony and the upbringing of a new generation in preference to a professional or industrial job.

V. These and similar estimates of supply and demand in this field are, however, but tools of varying value. They should be placed in the hands of the policy-maker and the administrator as indications only. The tools may, on occasion, be blunt; the estimates may be wildly inaccurate. Unless the policy-maker or the administrator truly believes in a philosophy of dynamic change and is capable of using common sense to come to a judgment on the many factors involved, the work of the statistician will not be put to its best use.

The absence of any infallible formula, however, does not make social foresight any less necessary. In some directions it may well prove impossible to probe into the future. In others it is possible, and failure to do so can be disastrous. To ignore the fact that in some vital industry, such as mining, there is an undue number of elderly workers, and hence to omit to make the necessary provision for the great replacement demand impending; to plan for higher standards of living but to neglect to provide the requisite technical training for those whose skill is necessary to make these standards possible; to fail to foresee the large extension in the demand for commercial and personal services as a country passes over to the stage where tertiary occupations increase rapidly with rising standards of living; above all, to educate a large part of the population for tertiary occupations which the economy of the country cannot afford: these would all be major blunders, the effects of which would be seen not only in the national income but still more in human lives and happiness. In matters such as these a flexible pragmatic use of the social sciences can be both a servant and an ally of enlightened administration.

CHAPTER II

TECHNICAL EDUCATION: PRESENT MEASURES AND FUTURE POLICY

I. Having established the principle that in a rapidly changing technological society social foresight is essential, and that occupational trends should therefore be forecast as far forward as possible to serve as a guide to the provision of technical education, the Conference gave prolonged consideration to the complementary question of the extent to which facilities for technical training and education are actually keeping pace with present and prospective technological needs in the different countries. Where deficiencies were noted the Conference discussed the steps to be taken to make more adequate provision, particularly bearing in mind the need to establish a proper balance between general and technical education. Technical education was considered from the point of view both of the instruction given in school and of the training given in industry.

In examining the measures already in force or in prospect, the Conference felt it important to bear in mind that no criterion of the adequacy of technical education could be realistic unless at the same time the goals towards which a country was working were borne in mind. Thus, elementary handicraft training and the technical skills taught within the family group may be adequate in a country whose social organization is still rudimentary. Similarly, a comparatively small amount of formal education, combined with small-shop apprenticeship training, may be satisfactory if the country intends to stop short at a commercial craft economy. Completely different standards of education and training will, however, be required if the people of a country are to have more food, clothing, housing and the various amenities which modern technology can supply. Rising standards of living and the maintenance of traditional techniques do not go together. Even the most advanced countries feel that they urgently need improved technical education if technological progress is to continue and the vision of a more abundant life for all is to become a reality.

II. Some preliminary examination of the position as it now exists in different types of countries, and the nature of the developments

taking place, may be of assistance in reaching conclusions as to the most helpful ways of carrying out such reorientation of technical education as may be required.

A. The Conference paid special attention to the position in countries in process of industrialization, and examined developments now taking place in India, Turkey and Brazil.

(1) In India, despite the fact that vast projects have been initiated by the Government in recent years for the construction of civil works, roads, canals, irrigation projects, the generation and transmission of power and the development of agricultural and industrial production generally, the process of technological advance is only just beginning. Furthermore, although Universities in India have been empowered to award degrees in technological subjects since 1857, only some 15,000 graduates in these subjects have been produced over the past 25 years. There is a grave shortage of technically trained personnel. To overcome this difficulty, the Government of India has decided to take five main steps:

(a) To establish in the course of the next 10 years four institutes of Higher Technology for Advanced and Post-Graduate Technical Training (of which one, the Eastern Institution near Calcutta, has already been founded).

(b) To develop institutions, such as the Engineering Departments of a number of Universities, at present in the formative stage.

(c) To improve and expand the training facilities of institutions which have already done valuable work in the field of technical education (13 institutions have already been selected for upgrading).

(d) To provide adequate arrangements for practical training of students in technical institutions in co-operation with state-sponsored or private industries, thus combining the "art" aspect of technology with the science of the subject as taught in schools and institutions.

(e) To establish a number of national research laboratories for research into problems of industry and for training the research workers needed by industry.

At the same time, as provision is being made for further technical education in the technical schools, while craft skills are being brought more and more into the curriculum of schools offering general education, the Ministry of Labour in India, using the war-time munition workers' training centres as nuclei, has prepared a scheme by which 7,000 literate boys will be trained annually as skilled workers for factories, although at a level below that of the technician, while 3,000 boys will be trained as skilled craftsmen for various types of cottage industry. When these projects are brought into operation, it is hoped that the dearth of skilled personnel for industrial development will gradually become less acute.

(2) In Turkey, faced with a similar problem (i.e. the rapid extension

of roads, ports and railways, the creation of a highly mechanized army and the development of agriculture and public works) steps are being taken at five different levels to extend and improve the facilities for technical education, and to strive towards a better balance in general education.

(a) At the level of the most elementary teaching, "travelling classes" in technical subjects are held in the villages and country districts, the aim being to give an introduction, over a period of one school year, to technical pursuits such as working with wood and iron and the construction of small village dwellings.

(b) At the second stage, for older pupils, evening classes are held in the technical and professional schools in the towns, or in apprentice schools attached to factories, the curricula for which vary according to local needs, but generally include carpentry, blacksmith's work, soldering, electricity, radio, etc.

(c) The third stage is represented by the intermediate industrial schools, for boys of 12 or 13 who hold the elementary school certificate, where a three-year course of study prepares pupils for the industrial college or institute.

(d) The fourth stage is represented by the industrial colleges, where pupils with the intermediate industrial school certificate take a two-year course of general and technical training, thereby preparing to become skilled workmen, foremen, workshop managers and designers; some of them will complete their formal technical education at higher technical colleges or universities.

(e) At the final stage the emphasis is on such subjects as mechanical, civil and electrical engineering, building, forestry, agricultural economics and architecture.

Whilst the number of graduates from the higher technical institutions is at present small, supply does not yet lag as far behind demand as in some other countries; for many young people who in the past would have regarded the Civil Service as the only avenue of employment after a general education on academic lines are now increasingly seeking employment in industry. Thus the products of both general and technical education are becoming available for productive work, a process hastened by the increasing introduction of technical courses and practical work into the curricula of schools formerly academic in their approach to education.

(3) In Brazil, a country where agricultural production and the industries dependent upon it predominate, and where it might be expected that an important place would be given to technical education and training in order to improve productive capacity, a very wide discrepancy indeed has existed (until comparatively recent years) between the facilities for education primarily of an academic type and those provided for technical education.

(a) In 1932, for example, two million children were in elementary

schools, 56,000 in academic secondary schools, and rather more than 100,000 in all other schools of intermediate or secondary grade (industrial, commercial, teacher training, domestic sciences, arts). Of these, only 14,000 students in 108 schools were receiving technical industrial training in the strict sense. By 1946, however, the number of industrial schools had risen to 1,480, and the number of students therein to 74,500; whilst a further 75,000 were undergoing a planned course of apprenticeship in factories and workshops.

(b) More significant, however, than the rise in numbers of those receiving technical training was the fact that a fundamental change in outlook towards this type of education had taken place throughout the country, a change which had already led to a profound reorientation of the administrative structure of education. Technical education, comprising industrial, commercial, and agricultural studies, had been redefined as belonging to the intermediate grade, on a par with secondary academic education. At the same time, it had been divided, along the lines adopted for secondary schools of the academic type, into two cycles. Students following the first cycle of academic secondary education are free to transfer to the second cycle of industrial, commercial, or agricultural education. Similarly, those who complete any one of the technical courses may enrol in the second cycle of the academic course, while those who complete the second technical cycle may apply for admission to the appropriate faculties of Universities.

(c) As far as training within industry is concerned, the most important recent developments in Brazil have been the creation of the two services of Industrial and Commercial Apprenticeship, which, though administered by private industrial concerns, are sponsored and supported by the Government. A law has been enacted to the effect that all apprentices in industrial firms between the ages of 14 and 18 must receive technical and cultural instruction on a part-time basis. This movement is extending rapidly, and it is hoped that before very long much of the prejudice which has existed in the popular mind against technical education and training may be broken down. A useful start has certainly been made in the effort towards increasing the prestige of technical education, which in the past has suffered by unfair comparison with the traditional instruction of the "academic" elementary and secondary schools. This development is all the more noteworthy when it is considered that Brazil's fundamental problem in the field of education is still that of 55 per cent illiteracy amongst the population of 15 years of age and older.

(4) Broadly speaking, in the areas typified by India, Turkey and Brazil, technical instruction has for the most part to be picked up on the job. As the above accounts show, determined attempts are being made

to systematize technical education. But so far the technicians thus trained are no more than a trickle in comparison with the rapidly swelling flood of technological development in these regions of the world.

B. Countries with a more fully developed industrial system, such as Australia, Belgium, France, the Netherlands, Scandinavia, Switzerland, the United Kingdom and the United States, present a marked contrast, both in the scope and in the volume of technical education, to the Far Eastern, the Middle Eastern and Latin American countries. Although technical education takes the form of both in-school education and learning in employment, the highly industrialized countries place far greater emphasis on extensive technical education in schools, both on a full-time and a part-time basis. Two main reasons may be adduced for this difference of emphasis. First, both legally and practically, the school-leaving age is generally considerably later in the highly industrialized countries. Secondly, the increasing complexity of technological processes in these countries demands that the worker should know more about the scientific principles underlying the operations of industry than was ever necessary in the comparatively simple craft economy. This second point is of special importance. Frequently, the conditions in which industrial operations are carried on do not permit of any broadly based teaching of scientific fundamentals within industry itself. The view was expressed at the Conference that the main responsibility for such teaching should therefore rest with the technical schools, colleges and higher institutions of learning generally, the essential task of in-industry training being to inculcate the purely practical knowledge required. This does not imply any opposition or competition between these two main aspects of technical education. On the contrary, they should be regarded as complementary parts of a well-rounded and realistic educational development for the young worker, every effort being made to bring those engaged in these two types of instruction into friendly and co-operative relationship.

In considering that part of technical education which is generally not provided within industry itself, three main types were distinguished: the full-time secondary school; the full-time or part-time technical institute; and, at the most advanced stage, the universities and institutions of higher technological study. A brief summary of each of these three types of "in school" technical education will suffice to indicate their general nature.

(1) The practice of technical education in the secondary school on a full-time basis varies widely amongst the industrialized countries. In the U.S.A., for instance, a large proportion of young people remain in full-time schools until the age of 17 or 18. As a consequence, a considerable development of technical high schools has taken place. In the majority of European countries the school-leaving age of young

people wishing to make a career in industry is much lower. Here the emphasis has been placed on general education up to the age of 14, 15 or 16 (with a technical basis for those desiring it) rather than upon the acquisition of particular industrial skills. Whereas in the U.S.A. the technical high school leads many students directly to the universities at the age of 18, in Europe and Australia the ladder of approach to institutions of higher learning in the technological field does not lead directly from school, but by way of technical institutes of a post-school intermediate type.

(2) In technical institutes, which have developed considerably over the past 20 years, technical education takes two forms: full-time training for those who desire to postpone their entry into industry for a year or two so as to take a technological course of study; and part-time training, by day or at night, for a large number of young people who desire to improve their industrial ability, either by classes strictly related to their particular occupation in industry, or by broader courses designed to provide the essentials for advancement to higher positions of responsibility. The extent to which these facilities for full-time and part-time education in technical institutes are used by young people, and the considerable growth in attendance during recent years, may be illustrated by the following statistics drawn from the reports of the Ministry of Education for England and Wales.

Technical and Commercial Institutes

Year	*Full-time students*	*Part-time day students*	*Evening students*
1937-8	14,000	51,000	1,179,000
1949-50	39,000	257,000	1,922,000

(3) At the highest level, development has taken place in universities, in large technical colleges for full-time and part-time students, and in specialized institutions of university standing devoted entirely or almost entirely to technological studies.

In most of the highly industrialized countries, universities now have technological departments in engineering, metallurgy, and allied subjects, the aim being to give a solid grounding in fundamental theory. In the technical colleges, as developed in Great Britain and Australia for instance, whilst fundamental theory is not neglected, a greater emphasis is laid upon the applied side of technology. In the specialized institutions of university standing, such as the Massachusetts Institute of Technology in America and the Federal Technical University in Switzerland, an attempt has been made to co-ordinate the scientific and technological aspects into a single whole. The aim of these institutions is to produce, at the highest level of attainment, not only the skilled industrial research worker, but the manager and the top-

level industrial executive whose contribution is so essential to the imaginative and informed planning of large-scale industrial developments.

C. Turning from technical education in schools to technical education in industry itself, it may be of value to trace very briefly the main stages in the development of modern technology and the type of training required at each stage.

(1) The earliest kind of technology—the self-sufficient household production of the relatively primitive society—presented no intricate training problem. Children learnt as they grew. The next stage, that of a commercial craft economy, was characterized by an elaborate and minutely regulated system of apprenticeship. Skills had increased, and more and more technical problems had to be solved. But it was technical experience rather than technical knowledge that was required and transmitted.

At the next stage, factories, with their new tools of production and the ever-extending principle of the division of labour, brought further changes in the forms of training. Technical knowledge gained in importance and was increasingly taught in schools. The operational skills underwent considerable changes. Only a section of the factory workers required skills similar in breadth and character to those of the old craft trades. Another part of the labour force needed extensive training in the use of machine tools, while a third group required aptitude in only a few highly specialized operations.

The new training system which grew up was more diversified, less formal, and far less rigidly controlled than the old apprenticeship system. For craft skills, the factories usually relied upon workers who had learned their trade in small craft shops. Many of the new trades, however, had to be learned in the factories and industrial apprenticeship was developed. This was similar to the old system, but was not subject to its regulations. It changed in character and developed, partly into very systematic training, partly into a loose form of tutelage not very different from learning while working, but without any form of learner-contract. This latter practice spread considerably.

Finally, mass production may be considered the fourth stage in the evolution of production technique and training. The processes of production are minutely planned in advance, often by university-trained specialists. Engineers, metallurgists, designers, and production experts co-operate to develop a plant which increasingly takes the form of one huge single machine. They determine the forms and materials of the commodity, the work processes, and even the tools, fixtures and individual operations. The division of labour becomes minute and many single-purpose machines are introduced. Craft skills are still required to produce the specialized machine tools, dies, fixtures, gauges, etc. usually demanding an exceptionally high degree of precision. Production itself, however, is largely in the hands of

operatives who are usually classified as semi-skilled workers. Their work comprises a few operations, which are briefly but effectively demonstrated to them. Thereafter they learn by repetition, and in a few days or weeks they may be able to perform these operations with greater speed and accuracy than a craftsman.

(2) The in-industry educational and training system which has developed in line with these fundamental changes in technique is still in a stage of flux. Whereas among some peoples there is a long and honoured tradition of apprenticeship, in others—the "new" countries —such a system has never properly taken root. Moreover, the technological requirements are nowhere homogeneous, either internationally or within any particular country. No people has gone over completely to mass-production methods, nor is it ever likely to do so. At the same time, no people using modern technology can remain completely unaffected by the mass-production form of organization.

Accordingly, certain general tendencies, at first apparently contradictory, but in fact directed towards a common focal point, may be perceived. Some industrialized countries, including the United States, have made efforts to rebuild the system of apprentice training on an organized basis. Government, employers and trade unions have co-operated to fix practices and standards, with the aim of expanding and improving this form of training.

In countries which have throughout maintained extensive apprentice training, general supervision continues to be exercised by guildlike organizations of established master craftsmen. They conduct the examinations and grant the journeyman certificate, which is a prerequisite for the master's examination. Once the man becomes a master he is entitled to employ apprentices, which is a desirable privilege and adds to the entrenched position of the apprenticeship system. Since most of the apprentices are employed by small workshops, much stress is given to old craft skills. In such countries, handicraft apprenticeship has had to be increasingly supplemented by industrial apprenticeship, with a growing emphasis on the use of machinery, advanced production methods and technical instruction.

III. Up-to-date technical education, whether in schools, in industry, or both, is not sufficient to create an effective working force. Behind the technical instruction it is essential to have a sound general education, even on purely utilitarian grounds. If there is not the underpinning of basic knowledge, no amount of training in technique can get beyond a certain stage, while the possibility of readaptation, should the need arise, is greatly reduced.

At the same time, a just balance must be held between the facilities given for technical education and the attractiveness of the more traditional forms of scholarship. This is not always done. The tendency of the intellectual to create men in his own image is strong. It is also

dangerous. If a country, by conferring prestige, amenities and security upon an academic type of training, sets out to produce in mass the man who never takes his coat off, it will have served its people ill.

To find a means of steering a middle way between these two extremes—emphasis entirely upon training in technique, emphasis entirely upon training for a cultured life—seemed to the Conference to be the essence of its task.

A. The place of technical training in the general school system of a country obviously depends in large part upon the school-leaving age. When school attendance ends at 14, the curriculum mainly provides instruction in reading, writing, arithmetic and in the use of the mother tongue. Such subjects as algebra, geometry, and physics are also usually included, but the extent of instruction in these fields is necessarily limited. Workshop instruction may or may not find a place in the curriculum, depending upon the philosophy of education held by the policy-forming authorities. Even where such instruction is offered, it is usually kept at a minimum and serves as a subsidiary to general education rather than as a preparation for specific occupations. Industrial countries generally feel that the full eight years of schooling are required to provide the essentials of general education.

B. Areas faced by different problems may decide otherwise on this issue. India, for example, proposes to develop a system of basic education lasting seven years, centred on manual training and gradually assuming an occupational character. This approach is based upon the principle of "learning through activity"; but it is also held to be in line with the economic and technological conditions prevailing in the country. In general, it has been argued, a country in the early stages of industrialization may not be able to develop a school system giving general education unless it provides occupational preparation for work at a relatively early age.

C. While the content of elementary education in general shows relatively little variation within a country, or from country to country, secondary education has gradually assumed a considerable amount of specialization and diversification. The term itself has changed its meaning and is now differently defined in different countries. Traditionally, secondary education was intended to be an education following a primary or elementary education, furnishing the prerequisites for "higher education" at the university level. It usually began at the age of 10 or 11 and lasted for seven to nine years. Since it was preparatory to university study, only a small percentage of young people enrolled in this type of curriculum. The majority, 80 to 90 per cent, or more, completed a basic education ending at 14 or 15 years. This was a terminal curriculum and did not provide the opportunity for later entrance into a university.

D. Today nearly all industrial countries recognize that this traditional arrangement does not meet the demands of modern times and

they are engaged in making school reforms of one kind or another. While in the past the completion of secondary education depended largely upon the financial status of the parents, much of the emphasis at present is put on the abilities of the children. Secondary education tuition is provided free or scholarships are granted. This mitigates class distinctions in education and increases equality of opportunity. At the same time the content of secondary education and the entrance requirements of universities are being revised. The general effect is to bring secondary education into closer relation with occupational requirements.

E. There is now a tendency to postpone the decision as to the type of education a child is to pursue. This is done, for instance, by making secondary education begin at the age of 11 or 12 instead of 10. Still another development is the vast extension of secondary education, working towards the system in which the road to the university will be open to all.

Thus, Great Britain has decided to transform education after the age of 11 into secondary education with a wide choice of curricula: (1) One type will be similar to that of the traditional grammar school, extending to the age of 18, and designed for the intellectually able pupils who may go on to the university, higher technical education or the professions.

(2) A second type will provide technical education stressing, in addition to general education, such subjects as mathematics, science, technical drawing and practical workshop instruction.

(3) Finally, a "modern school", to which the majority of the children will go, will offer a general education, including practical activities and instruction adapted to the needs of the community. The modern and the technical schools, however, although of secondary character, last only to the fifteenth birthday and therefore do not lead directly to the university. Great Britain plans to extend this education beyond the fifteenth year level and supplement it by an increasing amount of part-time education. Thus these school programmes may develop into an education which is truly secondary in the sense that it provides opportunity for further study at the university level.

F. The integration of all education into a continuous system extending from primary school through the various types of secondary education to the university increases equality in educational opportunities and allows the country to benefit from the special gifts of a much larger student body. The integration, however, becomes increasingly difficult as secondary education expands. If all children go to school beyond the age of 14, the secondary curriculum must be diversified and adjusted to provide for a great many occupations and careers. But then the question arises whether the universities will modify their admission requirements and accept new types of secondary curricula as adequate preparation for university work. Generally

speaking, so long as the classical curriculum ranks highest with the universities, the other forms of secondary education will be regarded as inferior, although they may be closer to the practical requirements of living and to the general cultural activities in which the student will actually participate. A traditional policy of admittance to university studies has therefore a restraining influence upon secondary education and retards its adjustment to the needs of modern society.

Again, if the buildings, staffing and equipment of technical schools are manifestly inferior to those of academic schools, or those of technical colleges to the provision made for universities, many young people who ought to be taking technical courses, from the point of view both of their own abilities and of the needs of their local community and the country as a whole, will be dissuaded from doing so.

IV. The Conference, while realizing that no generalization could be applicable to countries ranging from those in the first stages of technology to those where mass production is entrenched, from 90 per cent illiteracy to a school-leaving age of 18, nevertheless felt that two broad conclusions could be drawn from this part of its work. In the first place, as modern technology is likely to develop and spread in the coming years, the need for more and better technical training *now* is far greater than is usually recognized and far greater than the actual facilities afford. In the second place, if increasing numbers of young people are to be encouraged to acquire this training, everything should be done to make technical education more attractive, more expert and more truly educational in the broadest sense.

There was, furthermore, a broad consensus of opinion that it would be wrong to favour one particular form of technical training. Training in schools and training in industry were complementary, not competitive. There was like unanimity that to develop technical training at the expense of a sound general education would be self-defeating. But the most significant point on which there was general agreement was that the importance of technical education went far beyond its obvious and immediate significance, since upon it depended in large part not only the efficiency of production but also the fundamental attitude which the men and women of tomorrow would adopt in facing the problems of a technological society. To master the machine it is necessary to know it.

CHAPTER III

THE CONTENT OF GENERAL EDUCATION, AND THE APPROACH TO ITS TEACHING IN A TECHNOLOGICAL SOCIETY

I. Two principal questions on the content of general education were put to members of the Conference. First, what positive measures are actually being taken, or are in prospect, to ensure that the general education given has sufficient practical content to serve as a preparation for other than clerical and analogous occupations? Secondly, did not general education in most countries lack the practical element —the "know how" as contrasted with the "know about"—and what measures might be taken to make good this deficiency? Some study of the replies given by different countries may be of value in coming to broad conclusions in this field.

II. A. In countries such as Turkey, India and Brazil, where technological development had not yet reached an advanced stage, there was considerable agreement on the point that general or academic education did not contain a sufficient practical element, though certain measures to remedy the situation had been taken.

(1) In India, for example, the whole religious and social background of the country's long cultural history tended to place the educational emphasis in the schools on the acquisition of the outlook of a scholar and an appreciation of the cultural past. The predominantly individualistic approach of the Hindu religion, and the stress laid upon the individual's own relationship with the Universal Spirit, had made adjustment difficult to the needs of a technological society for group, or co-operative, activity. In 1938, however, it was decided that teaching in the elementary schools should centre round some manual, productive work, and a compulsory two-hour daily period of crafts was introduced for children up to 14 years of age. It is still too early to assess the results, as in many areas compulsory full-time education does not extend beyond the age of 11, and great variations of law and practice exist. For example, of the nine states of India from which detailed information is available, the school-leaving age is reported as: 10 in Orissa and Travancore-and-Cochin; 10 in Madhya Pradesh for children having duly completed four years' compulsory schooling, and 14 for other children; 10 in West Bengal in urban areas and 11 in

rural areas; 11 in Bombay, or earlier if a child has completed four years' primary schooling; 11 in Bihar in primary schools and 15 in basic schools; 12 in Assam, or on completion of five years' schooling; and 14 in Madras (12 for girls) or on completion of six years' schooling.
(2) Similarly, in Brazil the school system until recently followed an old-fashioned academic tradition, and there was no link whatsoever between the training of apprentice craftsmen and other branches of teaching. Steps are now being taken to provide a free interchange of pupils between secondary schools of a primarily academic type and other schools of equal importance engaged chiefly in industrial, commercial and agricultural studies. This interchange is co-ordinated with a system of industrial and commercial apprenticeship on a compulsory basis, whereby firms are obliged to arrange for the instruction of their young employees between 14 and 18 years of age in both technical and cultural subjects.
(3) In Turkey, the predominant purpose of general education in the past was to prepare students for two main types of occupation—the Army and the Civil Service—both of which commanded a very considerable prestige in the eyes of students and their parents. In general, academic education has lacked any real practical element, but of recent years certain measures to remedy the situation have been taken:

(a) Special classes devoted to manual activities have been introduced into the secondary schools.

(b) In rural districts (which include more than 80 per cent of the Turkish population) village institutes have been set up, to impart practical technical knowledge as well as general education.

(c) The middle schools (attended by children of 11—13 years who have obtained a certificate at an elementary school) organize practical classes devoted to wood and metal work and commercial subjects for the benefit of those who are unable to continue their studies after the middle school stage.

B. In "new" countries such as Australia, the main emphasis in general or academic education until the age of 12 at least, and in most cases until the age of 14 or 15, is on the broad development of the personality of the child as a whole without any vocational bias. The courses given in the high schools comprise very little practical work, with the exception of those in science training. Craft skills, where they are taught in the junior technical schools, are regarded as part of the all-round development of the personality of the individual student and are at all times linked with other subjects, since it is considered important to give the pupil a solid foundation of general education (including the basic principles of science and mathematics) before he begins the theoretical and practical studies directly related to his occupation.

C. In the older industrialized countries, such as France, Belgium, Denmark, the Netherlands, Switzerland, Sweden and the United

Kingdom, the tendency is likewise to exclude practical, and in particular occupational, pursuits as far as possible from the content of general or academic education.

(1) There are signs, however (in the United Kingdom for example) that the curriculum of the grammar schools is being broadened to take in more workshop activities than in the past. The new type of examination system now being introduced—the General Certificate of Education—will influence this development in a way which the older type of "School Certificate" examination, with its highly theoretical and academic approach, could never do. At the same time, industry in the United Kingdom by its constant demand for the good grammar school product is doing much to break down the social snobbery which used to demand that the grammar school pupil should go only into "black-coated" jobs. As a consequence, industrial work (provided there is a reasonable chance of promotion for the bright youngster) is slowly gaining in the esteem both of pupils and their parents.

(2) In Sweden, Denmark and the Netherlands, whilst general education is still predominantly influenced by the nineteenth century ideal of giving as broad a basis as possible in history, literature, scientific principles and the use of language, developments are taking place to enlist student's co-operation in making the courses more suitable to modern needs. Particular emphasis is laid on clarity in speech, writing and the individual's own thought. This, it is felt, not only ministers to his general development as a personality, but also provides a foundation for future useful work in the fields of commerce, economics, banking, etc. which are so vitally important to the prosperity and financial health of these countries.

(3) In Belgium, Switzerland and the United States, co-ordination is achieved between the schools providing basic general education and those giving technical instruction by a system which provides for complete parity of esteem and frequent opportunities for interchange between one kind of school and another at different stages of the students' development. Furthermore, in Belgium, for instance, there is an increasing tendency to introduce "general" subjects, such as the mother tongue, history, geography, natural science, physical culture, etc. into the technical schools, while at the same time encouraging teachers in the non-technical schools to take their examples from the child's immediate environment—local industries, institutions, manners, customs, etc.; to provide frequent exercises in manual work (cardboard, wood, iron, etc.); and to relate the teaching of science, for example, to such a practical operation as constructing a bicycle or a piece of electrical equipment.

(4) In France, general education in the past contained few or no practical exercises. The higher forms of secondary education, for example, were almost exclusively designed to produce the "white-collar" worker. As a consequence, children left school with little

understanding of the realities of life around them. To counteract the influence of such teaching, frequently found to breed frustrated "intellectuals", in 1946 a new system bearing the name of "les classes nouvelles" was introduced in a certain number of high schools; this induced a more lively appreciation of the importance of group action and practical activity of a realistic kind. The main characteristics of these "new classes" were:

(a) The child was given a much closer contact with his locality and immediate environment.

(b). He was taught at a comparatively early age about such matters as the practical working of a large administration, and in this way was given a new view of life, both as an individual and as a member of a group.

(c) The curricula included manual work and drawing, intended to develop the child's artistic gifts and also to give him a basic technical sense and knowledge which might be useful to him in later life.

(d) The co-operative spirit was encouraged by group research projects within the classes, carried out by the pupils themselves.

III. From this necessarily brief review of the outlook of the different countries represented at the Conference regarding the practical and realistic content of general education, and the measures taken or in prospect to make adjustments to meet the needs of young people in a technological society, certain general issues may be distinguished and certain general lines of approach to a solution may be suggested.

A. The first principle that emerges is that general education in an industrial civilization cannot content itself merely with providing knowledge but must also, in a number of different ways, prepare the student for *active* participation in life. The basic tool-subjects of general education—reading, writing, arithmetic, grammar and scientific principles—are dual purpose. They are of fundamental usefulness in helping the individual to live a good and full life in society. At the same time, learning actually to use these tools is an essential preparation for productive work. "Doing" is as characteristic of modern culture as "understanding", "know how" as important to man as the "know about" and "know why". Unless the teaching method in schools of general education is so orientated as to provide this basic appreciation of the "know how" in life it will fail to meet the needs of tomorrow's pupils and today's. General education, therefore, should not be regarded as "non-vocational" education, for it has a profound vocational significance in the broadest sense; the distinction should be made between those subjects and topics of general importance which form the background of every student's education, and those topics of special importance (such as technical training in engineering, building, or banking) which are taught to groups of

students at a later stage of their educational careers when they are specifically preparing to enter the occupations concerned.

B. The second main principle is that the preparation for life and work provided by general education should include four main constituent elements: observation; action, co-operative as well as individual; reading and writing; and independent thought. In the past, general education concentrated primarily on the last two of these essential requirements. All four elements need to be brought together in co-ordinated action by the teacher, the student, and the school itself.

Many of our difficulties today are caused by the fact that students in school do not learn how to think, or to do and find things, for themselves—which should be the first aim of all education. Too much emphasis is laid upon the communication of second-hand information which is apt to stay in the pupil's mind only until examination time. No solution of the problem of the reorientation of general education can be found, therefore, in merely adding new subjects to an already over-burdened curriculum. A new way must be found of teaching the basic subjects as they exist, a way which lays stress not merely on the student's ability to benefit by reading, but also on his capacity for using his eyes and hands and for co-operative enterprise, whether in the workshop, the theatre, the school camp or the playing field.

C. Furthermore, if one of the aims of a truly balanced general education is (as the Conference believed it to be) to help to build a just and ordered democratic society, opportunities must be found during the course of that education to introduce the student at first hand to political activity and the democratic procedure of self-government, with a view to widening the whole range of his interests. The examination of current national and international political and economic issues should enable him to understand, among other things, that the study of history is not mere chronology, but an all-embracing view of the technical, economic, political, social and cultural organization by which peoples live.

D. Whilst general education is universally recognized as of supreme importance in introducing youth to literature, history, the arts and science, and as doubly effective if this introduction can be so ordered that it includes the acquirement of creative skill, can general education also introduce the youth of the world to technology and all that it involves in the present age?

With the help of modern technology, man is acquiring more and more goods, but understands less and less of their production, construction and operation. It has been well said that people find it terrible if told that a child has never seen a cow, but take it as a matter of course if a child has never seen a factory. Occupational specialization and the removal of production from the household have made it infinitely more difficult for man to comprehend the

technical world in which he lives. And what we do not understand we are liable to distrust and fear, or at best ignore.

If general education is to provide a broad and realistic introduction to life, it must help the student to close this gap in his experience and understanding. The success of general education in this scheme will depend greatly on workshop facilities and the quality of workshop instruction. The practical side of school life needs to be increasingly recognized for the contribution it is able to make to general education —it is an opportunity for children to develop their inherent manual and artistic skills, without in any way leading to specific vocations. Workshop activities give a training to eye, hand and mind which may prove invaluable in later life. And for those who eventually follow a non-manual occupation, workshop instruction is no less vitally essential, since its emphasis on direct creative activity helps to build a general self-reliance in the individual and to develop a well-rounded personality.

IV. Thus, in brief, the Conference concluded that:

A. There need be no antagonism between learning through observation and action and the acquisition of knowledge through books. Each form of activity supplements and supports the other. The schools should therefore carefully cultivate them together.

B. Whilst the individual child is at the centre of the educational system and must remain so, he will not find himself as a maturing personality, able to meet the shocks and tensions of a disturbed and often unhappy society, unless he also engages in creative and co-operative activity with his fellows.

C. The hands as well as the head need to learn; not only because this may have some possible occupational usefulness but, still more, because it contributes to the all-round development of the growing human being.

D. What is required is not so much a new kind of curriculum (although this also may be necessary) as a new kind of teaching; and with it a new kind of aim in education—the fitting of the young person to master technology, not merely to become one of its cogs.

CHAPTER IV

THE CONTENT OF TECHNICAL EDUCATION, AND ITS RELATIONSHIP TO THE CULTURE OF THE WHOLE MAN

I. In considering this part of its agenda the Conference was faced at the outset by the challenging question whether technical education in most countries were not seriously defective in cultural content; and, if this were true, what steps could be taken to remedy this position. The Conference recognized that grave mental and moral dangers were inherent in any technological society which turned its back on culture, taking this term in its deepest sense as meaning the development of the whole man.

From the discussion on this problem it was clear that a more rigorous analysis was necessary of the meaning of "cultural content" in the present context. Particular emphasis was laid upon a statement by Sir Alexander Carr-Saunders, in a lecture on the relation between culture and technical training, that every attempt in the past to give merely a veneer of culture to technical instruction had proved unsuccessful, and that the right method (which depended very largely upon the faith, outlook and qualifications of the teacher for its success) was for cultural studies to grow naturally out of the subject-matter of such training.

In the view of the Conference, the important practical problem was how to ensure that a young person, who was rightly desirous of making himself expert in a particular branch of an industry, trade or profession, should at the same time be given an education in his early years, at the primary, secondary and technical levels, which would provide a bulwark against the disintegration of the personality liable to result from a technological environment. The danger lay not only in the narrowing effect of many types of work and in excessive specialization but also in the misuse of such inventions as the radio, the film, television and other products of a "gadget" age.

II. With the problem thus defined, the Conference found itself in broad agreement on a number of general points.

A. Since the initial contact with education is made through the medium of the primary or elementary schools, whose main task is "general education", the young worker's attitude to cultural pursuits,

when following what may be an almost exclusively technical course of study, will necessarily be influenced by the way in which his early teaching was conducted.

(1) Therefore the first steps need to be taken in the primary or elementary schools. If a child early acquires an intellectual curiosity, or an interest in reading and the arts, he is likely to retain that interest at a time when his primary concern is to acquire some occupational skill. Furthermore, if his education can be developed along the practical lines suggested in the preceding chapter, he will be less likely to regard the subjects taught in the elementary school, and the method of their teaching, as being totally alien from the real world and therefore useless, fit only to be discarded when he comes to strictly vocational training.

(2) On the other hand, no system of general education, however broadly devised and wisely communicated, which stops short at the age of 14 or 15, can in itself do more than lay the foundations of a personality capable of standing against the mental and moral dangers of a "mass-produced" society. This applies with even greater force to education cut short at the age of 11 or 12, as it is in a number of countries. Consequently, although (as the Conference recognized) a high school-leaving age cannot everywhere be achieved at once, the greatest possible effort should be made in all countries to extend the age of compulsory full-time attendance.

B. At the next stage, when the young person is definitely engaged on occupational specialization, there arises the problem of how technical and general education can best be combined. The Conference here squarely faced the central difficulty that post-school education is bound to be very largely on a part-time basis, so that there is at one and the same time more things to teach and fewer hours to teach them in.

(1) The cultural content of education at this stage should be determined with particular care; otherwise it will fail to capture the interest of young workers and thus become a boring and a burdensome task, rather than an opportunity for personal development. Often, the occupational interest of the student may prove the most appropriate focus for general education. If, for example, the student is an industrial apprentice, his trade instruction may, under a skilful teacher, be elaborated into an education in the sciences and mathematics. Similarly, the history of the trade itself may provide opportunities for social and economic studies in the broader sense, whilst all fields of instruction can be utilized to teach the student the effective use of the mother tongue.

(2) In this latter connexion, the general experience of the Conference was that one of the gravest deficiences in the armoury of young workers was the inability to express themselves adequately in their own language. Often, indeed, they had no interest in language or literature,

and in such cases the first thing to be done was to introduce them to these studies along new lines. One way of doing this was by teaching them to appreciate modern forms of literary expression—novels, essays, plays—as fascinating and complicated structures, requiring as much thought and care in their fashioning as a bridge or a railway engine. Similarly, occupational concern with problems of design might well lead to a new appreciation of the arts, and of the possibility of expression so provided.

(3) At the same time the approach to technical education itself needs to be wisely made. Grave harm may be done if the impression is given by the teacher that shop-work is necessarily of a narrow occupational character. Every trade needs to be studied for its cultural interests and values. In the clothing trade, for example, related technical instruction may include designing and the history of fashions, costumes, and art in general. Similarly, students in the building trades may learn about architecture in the course of their studies; whilst students of the manufacturing trades should be encouraged to see the history of production techniques and inventions as a living pattern of events in which they themselves are taking part. From this study of the history of particular industries may spring more general studies of social and cultural development, particularly in the field of labour relations and economic policy.

(4) Again, the process of integration between general and technical education may be facilitated (particularly in the full-time secondary technical schools) by the teaching of technical and general academic curricula in the same school building. Students in the two fields may have some classes together, thereby helping to increase the practical element in the one and the cultural content in the other; whilst the mixing together of students of different types in sports and social activities can help to create and maintain a sense of community regardless of specialization.

C. Not only should a solid link be forged between general and technical education during the secondary period but also at the stage of higher training in the technical institute or university. Too often technical institutes tend to concentrate exclusively on technical instruction, if other subjects are included in the curriculum they tend to be brushed aside as unimportant. Similarly, university students tend to concentrate exclusively upon those subjects which are directly connected with their chosen occupation or profession. Although natural enough, viewed more broadly this concentration is highly undesirable. Secondary education ends and university study usually starts at the age of 18, that is to say, at a time when real understanding of social, political and cultural processes is just beginning. Universities therefore cannot be satisfied with offering only professional training. To turn out technicians is only part of their task. A living community also needs leadership and in a democratically organized educational

system it is from the ranks of the universities that this leadership must largely come.

D. The expansion of the university curriculum to include both professional and general cultural education, however, raises serious problems. The student will usually feel that his time is already overtaxed by the specialized courses which prepare him for his examinations and therefore require his first attention. Similarly, although the university teachers may agree upon the need for a broad education, they are still likely to suggest that the student receive intensified instruction in his specialized studies because of the growing complexity of the subjects.

(1) To overcome this problem, students in some countries are required to complete two years of "liberal education" at the university level before concentrating upon their chosen field of study. A generalization of this arrangement, however, may be neither possible nor advisable. At the age of 18 a student often has definite occupational interests, the pursuit of which may well be of help in developing his personality. If he is nevertheless to obtain a broad education he must necessarily acquire it while following his professional studies.

(2) Here also the best results seem usually to be achieved by weaving general cultural interests into technical training. Advanced instruction in engineering, for instance, can be related to technical and cultural history, to working conditions or to business and social organization. The student's attention may be drawn to the price that society pays for adopting mass production as well as to the advantages resulting from this technique. He may be taught mechanization of production and at the same time be stimulated to think about its effect upon life, to face at the outset the problem of how man can use the machine instead of being used up by it.

III. Some examples of how the principles and practices described above are being applied today in certain of the countries represented at the Conference may help to give substance to the foregoing analysis. In the United Kingdom, "Colleges of Further Education" are being established to bring together students of technology, commerce and art under one roof with others studying philosophy, psychology, domestic science or the language and literature of their own and other countries. In the Netherlands, the cultural and general content of the education given in technical schools is being strengthened, so as to permit of a more extensive movement between the technical schools and the academic high schools than in the past. In Denmark, great stress is laid upon the scope of the courses at the primary and secondary academic levels; so that more and more widely read and intelligent young people will tend to enter the technical institutes with a sound foundation which prevents narrow specialization at too early an age. In Belgium, stress has been laid both upon the inclusion of a wide

variety of general educational subjects in the technical schools and institutes, and upon the fundamental dignity of technological study in itself; including, as it does, those qualities of reasoning and deduction which lead naturally to a curiosity of mind favouring cultural development. In Switzerland, the great importance placed upon fundamental studies in science and mathematics in the training of the technologist, and the universal postponement of specialization to a late stage in the student's career, encourage a breadth of outlook and a quality of mind which is far from the narrow singularity of interest of the technocrat. In France the conception of technical training is similar to that in Switzerland. A rational application of the mathematical and physical sciences, coupled with an up-to-date and realistic treatment of such subjects as literature, history and geography (which are normally to be found in the curricula of French institutions) prevents technical training from having an insufficient cultural content. In general, therefore, it can be said with some truth that the need for an adequate cultural content in technical education is appreciated in the highly industrialized societies, and that, with few exceptions, action is increasingly being taken to meet it. On the other hand, how far the movement has actually gone, how much is plan and how much practice, is a matter on which more information is required.

IV. From the foregoing sketch of some of the principles involved in the integration of general education with technical study, and of the nature and extent of present practices, three main lines of future development may be distinguished. First, the improved selection and training of teachers; unless the instructor in technical subjects himself has cultural interests he will not be able to convey them to his students. Secondly, as an aid to teachers, certain particular courses of study may usefully be included in technical education: in particular, adequate mastery of the mother tongue, possibly also an additional language and such topics as current affairs, industrial, social and economic history, the science of management and social and industrial psychology. These can be of the utmost value, provided that they are not taught in an abstract or academic fashion but as themes naturally developing from the student's occupational interest. Thirdly, the process of education must be regarded as continuous throughout life. If the right foundations are laid in the early years, there is every possibility that they will be built upon later. To ensure the soundness of the structure the whole system of adult education, both technical and general, should be brought into play and particular attention should be paid to its effects upon the industrial worker.

CHAPTER V

EDUCATION AND TRAINING FOR OCCUPATIONAL FLEXIBILITY

I. At every stage of its discussions the Conference was powerfully influenced by a realization of the ever-increasing need for occupational flexibility—the readiness and ability to engage in new types of work as the old become obsolete. The purpose of the present chapter is to review briefly the measures taken or in prospect in different countries to secure such adaptability and to suggest certain guiding principles.

In this connexion the Conference had to face one of the paradoxes of modern technology, viz. that whilst such developments as mass production and the increasing division of labour demand considerable occupational flexibility if the system is to be kept in proper equilibrium, by their very nature they tend to create new forms of narrow specialization.

II. Education for occupational flexibility operates at three main points: in the schools providing in the main for "general education"; in the schools with a specifically technical bias; and in industry itself, both in its general training and in its schemes of apprenticeship.

A. In countries such as India, Turkey and Brazil, where industrialization (although rapidly taking root) has not yet reached an advanced stage, the necessity for occupational flexibility is already becoming apparent.

(1) In India, for example, the vast projects planned by the Government for the development of natural resources and the creation of new industries demand a large number of technologists, technicians, and literate skilled and semi-skilled workers. At the same time, the high schools annually produce some 300,000 entrants to what may be termed the "middle class" of the community, a class which during the late war managed to solve its unemployment problem, but which is once more in grave difficulties now that purely academic studies no longer hold out bright financial prospects. Unless, it is felt, a considerable proportion of these highly-trained young people can be absorbed into work of a technical character, the real income of the middle class as a whole will fall disastrously; and at the time of its

greatest need the country will be deprived of the services of those who might be expected to play a leading and progressive part.

(2) In Turkey, occupational flexibility has been encouraged by the development of technical and academic training, and the constant reiteration of the truth that all work is honourable—not merely the type of work designed in the past to lead almost exclusively to employment in the Civil Service or the Army.

(3) In Brazil, the problem of achieving greater flexibility in the courses provided by the system of Federal and State vocational schools, has been tackled by providing better training and education for the teachers under the auspices of the Brazilian-American Commission for industrial training. The activities of this body have been focused on inculcating in the teachers a better social understanding of their task, on the publication of technical handbooks, on planned schemes of vocational guidance and selection, and on the analysis of local and regional labour needs.

B. In Australia, which may be taken as typical of a category of countries with vast possibilities of technological development, the considerable stress laid upon a sound "general education" in early years has been found to promote flexibility and adaptability of mind in the student. At the same time, the establishment of Apprenticeship Commissions in each state has been the means of raising the standard and widening the field of technical training. Under the guidance of these Commissions the apprentice not only receives all-round instruction in different aspects of the industry in which he is engaged; he is also educated for adaptability to changing conditions by means of part-time general technical training courses at the technical college, where the basic course is designed to provide a sound foundation from which development in a number of different specialist directions is possible.

C. (1) Both in the United States of America and in those industrialized countries of Europe where the apprenticeship system has not been extensively developed, one of the most pressing problems is that of premature specialization, particularly in those trades and industries where mass production methods are widely used. Certain measures can be taken, and indeed have been taken, by industry to meet this problem—notably those schemes organized by large firms whereby, at the early stage of his career, the young worker is given opportunities to observe and engage in widely differing types of operation in various departments of the enterprise. The great difficulty arises not so much with the large firms and corporations, but with the small and medium-size undertakings which by their very nature are not in a position to give a wide variety of training opportunities. It is here that co-operation between firms to provide for some measure of exchange of young workers during the training period can be of the very greatest value.

(2) In the Netherlands the importance of the general problem of flexibility and adaptability has been recognized, and considerable study is now being given to possible solutions. At the elementary stage, and in a large measure at the secondary stage also, the technical schools have eschewed specialization and have aimed at broad courses including non-technical subjects. Attempts are being made, moreover, to render institutions of higher learning and research (including the universities) more accessible to the student whose early training has been in a technical school; thus encouraging occupational flexibility at the higher levels of professional training as well as at the "craft" level.

(3) In Belgium, specific measures have been taken to promote adaptability to changing conditions. Under the authority of the Minister in charge of technical education a "Council for the Improvement of Technical Education", representative of industry (both managers and trade union leaders) and of the administrative and inspectorial divisions of the Ministry, is constantly engaged in adapting the curricula of technical educational establishments to new developments in technical progress. In industry, the various organizations of managers organize study and discussion groups for the purpose of maintaining efficiency in technical education. In the technical schools, "Competence Boards" of managers and workers have been established to see that the curricula are constantly adapted to technical progress, and to provide temporary "refresher courses" in new technological developments for former pupils.

(4) In Switzerland, the whole emphasis of the *Ecole polytechnique fédérale* is on a broad, general training founded on the basic sciences of mathematics, physics, chemistry, biology, etc., with specialization deferred to the fifth semester of higher study or even beyond graduation. Regular contact with industrial realities is maintained through workshop visits, so that at the end of the course the student is in a position to choose between a number of different occupations, without the danger that, as a narrow specialist, he will be unable to move without difficulty from one to another.

(5) Similarly, in France, extreme specialization has been strongly opposed in the technical schools, and industry has been greatly encouraged to develop apprenticeship schemes designed to give broad training in all those occupations which depend on the practical application of fundamental scientific principles. Particular mention should be made of the *Conservatoire national des arts et métiers*, which gives a higher education in applied sciences free of charge outside working hours. More than 15,000 young workers attend its courses every year; and although its aim is to enable them to qualify as technical specialists, the basis of training is far from narrow.

III. In the course of its discussion of occupational flexibility the

Conference found it necessary to give attention to a range of factors falling to some extent outside its terms of reference but none the less highly relevant. A single illustration may serve to make the point that the Conference had in mind. In a number of countries, such as Belgium and the United Kingdom, difficulties have been encountered in recruiting a sufficient number of workers for the coal mines, agriculture, and other types of heavy work. It appears likely, moreover, that an expansion of education and social security may increase rather than reduce such difficulties. Analysis of the situation has frequently revealed that the fundamental problem is a social one. The objection on the part of a young man to engaging in any work connected with the mine is that it marks him down as a creature apart, not only in his craft but also in the kind of life he and his family lead. He does not leave his work behind him as others do when he returns home. When he comes to marry, women are not always willing to link themselves, as they must, to the mine as well as to the man. The miner's wife is condemned to a narrow and laborious routine of heavy washing, in a house that no amount of energy can keep clean. Pit-head baths, decent changing and storage accommodation for the miner's working clothes, which enable him to walk home looking respectable and keep the smell and dirt of the mine out of the house, can remove much of the revulsion from a trade which hitherto has had singularly small success in its recruitment programme, despite the attraction of higher wages than those of most workers. Such considerations and improvements may not be deemed "educational". In the narrow sense they probably are not. In a wider sense, however, there is such a thing as social education, leading to the appreciation by society of certain fundamental values whose essence may be defined as the realization that man was not made for technology but technology for man.

IV. Having regard to the experience of the various countries represented and the problems peculiar to each, the general conclusion reached by the Conference was that the challenge of occupational flexibility in a technological society should be met by a co-ordinated effort in three different fields: in the schools and educational institutions generally; by means of links between the schools and industry, in the shape of apprenticeship schemes and vocational guidance arrangements; and by developments within industry itself.

A. In the schools and institutions of higher learning, three important steps could be taken to prepare young people to achieve the necessary adaptability:

(1) Stress should be laid upon the proper teaching of fundamental subjects—the use of the language, clarity and accuracy in speech and writing—and upon as comprehensive a knowledge as possible of such background subjects as mathematics and general science;

(2) The theoretical appreciation of fundamental principles should be

constantly tested against practical application in the shape of workshop activity of a character which should not be specifically vocational; (3) In institutions of higher learning the student should be constantly made aware of the relevance of his own special subject to other fields of study. The engineering student, for example, should not only be encouraged to extend his studies into mathematics and the pure sciences beyond the immediate requirements of his chosen field, but should also be introduced to such subjects as business administration, economics and management.

B. In view of the narrowness and early specialization of much industrial training and certain types of apprenticeship schemes, occupational flexibility may be enhanced by means of carefully coordinated part-time day and evening education in a technical school or college, additional to the training in industry. The purpose of this supplementary technical education for the young worker is twofold: on the one hand, he is able to observe work processes, special machines, and advanced methods of production which are not available to him in the workshop of his employer; on the other, he is introduced to production processes which involve different types of work and skill. Thus, instead of being trained only within the narrow confines of a single craft, the demand for which may fluctuate very considerably, he receives an opportunity to master related skills, so that at the end of his course he may be reasonably well prepared for more than one type of occupation.

C. Finally, the general consensus of opinion was that within industry itself, two types of approach to the solution of the problem of occupational flexibility should be given wider consideration:
(1) Arrangements whereby young workers, particularly those attached to medium-size and small firms, could be given greater opportunities than at present both to broaden their knowledge by working in different types of undertaking within an industry and to observe a greater variety of manufacturing processes, before finally settling upon their own chosen occupation.
(2) Recognition of the fact that the flexibility of the labour force is determined not only by education and training but also by social, economic and technical conditions.

CHAPTER VI

THE EDUCATION OF GIRLS AND WOMEN IN A TECHNOLOGICAL SOCIETY

I. In the course of its deliberations the Conference devoted particular attention to the most appropriate form of education for girls and women in a rapidly developing technological society. It did not feel itself competent to make detailed suggestions in this field, since none of the experts present had made a special study of the question. Unesco's reiterated efforts to secure specialists in this matter from the different countries had unfortunately not elicited the desired response. Moreover, in this field, more than any other covered by the Conference, wide differences in practice and in underlying philosophy among the different countries of the world render international generalization particularly difficult. Despite these handicaps, the Conference felt that it should put on record certain general principles which had been found valid by the participants in their experience of education, technology and the social sciences.

A. Both in highly industrialized communities and in those in process of industrialization, the role of a woman is increasingly a dual one. Not only is she expected to look after the home, to be responsible for the early upbringing and training of young children; she may also be a working citizen, earning an important part of the family income, contributing to the country's economic well-being in a number of vitally important employments, possessing the vote and the right to hold public office. Whereas in past ages women laboured in the field, in the dairy and at the mill, today the range of their employment in industry has become much wider; it is indeed still increasing continually in scope. In the non-industrial occupations their place is greater still. The nineteenth century governess or domestic servant has developed into the business girl, the nurse, the teacher, the civil servant. Although the so-called "learned" professions are not yet always open to them on the same terms as to men, they are no longer closed and monastic as in the past. In cultural, artistic, intellectual and political activities women are expected to play, and do play, an important part in the life of the nation. At the same time, research in sociology and psychology alike have shown the woman's part in homemaking and child-rearing to be of even greater importance

than was originally thought. It is largely in the earliest years of life that individual human beings acquire balance and integrity—the foundations of the whole man—or have their future distorted. The problem is then to take account of the dual function of women and to decide what kind of specialist training should be made available to supplement basic education.

B. In practice, this problem is frequently resolved by not giving girls anything beyond the most elementary education; and in some countries by hardly giving them education at all. Even in advanced societies, educational parity between girls and boys is often no more than an ideal. In many countries almost as many girls as boys receive primary education but only about one half as many receive secondary education and a considerably smaller proportion continue to the stage of higher education. This is a strangely inverted logic. The need is to prepare a woman soundly for two vital fields of work. All too often she is prepared for neither.

C. Education for remunerative employment is as essential to women as it is to men; not only does it help to develop a mature outlook and a responsible attitude, but it also assists in developing a sense of personal and economic security and an independent approach to marriage. Furthermore, society expects women to take up remunerative work to an extent undreamt of in the past. Today in most countries over 50 per cent of the women between 15 and 20 are gainfully employed; the proportions in England and Denmark, for example, are 75 and 86.3 per cent respectively. Even after the age of 20 the proportion is still high. It has been found in the United States of America, for instance, that some 45 per cent of girls and women in the 20-25 age group are at work. While the percentage declines thereafter, in highly industrialized countries some 25-33 per cent appear to remain in active employment of one kind or another.

D. The problem of planning forward, of estimating which occupations women may be expected to follow, and in what numbers, requires special consideration; especially in those countries where the role of women has in the past been a wholly subordinate one. Some guide to the appropriate adjustment of vocational education for women can be obtained from a study of the existing occupational distribution. Nevertheless, the fact that relatively few women have so far pursued certain careers must not be permitted to sway the educational administrator's judgment unduly. This failure to pursue a certain type of occupation in the past may very well have been due to a lack of suitable educational opportunity or to prejudice, and not to any inherent unsuitability of women for the careers themselves. Considerations such as this make forward planning much more difficult for girls than for boys. On the other hand, where women have attained an assured place, certain types of occupation do tend to follow a uniform pattern. It may reasonably be predicted, for example,

that typists and other clerical workers will leave their occupations sooner than teachers; the appropriate measures for more widespread clerical training to meet the demand for replacements should therefore be taken. Outside certain specific fields, however, the problem of accurate forecasting is very much more difficult.

At the moment it is broadly true that women have not achieved their fair share of positions in a very large number of professions—engineering, the law and medicine, for example—either because the training is too lengthy for women who do not wish to postpone marriage unduly, or because the type of work or the skill involved (as in engineering) does not come naturally and easily to many women. On the other hand, the growth of "tertiary" occupations in a technological society, tends to create a very large number of administrative, clerical and commercial posts, and here women are naturally able to play an outstanding part. It is particularly important that countries in process of industrialization should bear this phenomenon continually in mind.

E. There are, moreover, many vocations which in some measure combine the woman's two roles of home and career. "Personal" occupations—from hotel work and domestic service to nursing and child care, from dressmaking and interior decorating to teaching and social service—are in a sense dual-purpose. The girl who adopts them is doubly prepared for life. What is most necessary, particularly in respect of domestic work, but to some extent in all the personal service occupations, is the setting of high professional standards, with the necessary accompaniment of suitable working conditions and a fair rate of remuneration. The social recognition of this occupational field is of capital importance and the giving of education up to professional standards is one of the means by which this can be brought about. The workshop as part of general education is thus just as essential for girls as for boys, the only difference being in the nature of the workshop. Opportunities for learning about home-making, interior decorating, clothes design and fashions, nutrition, health and child care should prove of enormous value in providing satisfaction in the creation of a happy and well-balanced home and family life; and they can also lead to remunerative professional work.

F. Finally, even more than for men, education for girls and women needs to continue throughout life. The woman who adopts a career should be helped to make herself proficient in it, and not to look upon it as no more than a poor substitute for marriage. Furthermore, education, in the broadest sense of learning from one another, in clubs, in institutes, in discussion groups, makes possible that fellowship without which a full life is impossible. Marriage also needs to be seen as a skilled occupation, for which the preparation should not stop short at a course in domestic economy. Vital as it is for a wife to know thoroughly how to make a home and plan the housekeeping

budget to the best advantage, it is also important for her to be able to take an intelligent interest in her husband's work, to participate in the life and activity (cultural, social, artistic, political) of the community in which she lives and, above all, to become conversant with something beyond the traditional lore in the bringing up of children; so that man and wife can be a team, a harmonious and productive partnership. If this is to be possible, after-school training is normally necessary in three main directions.

(1) Domestic training is often needed for the young married woman who has left school early to seek a job, without any real preparation for the responsibilities of a home. This is being provided in a number of countries (e.g. the United Kingdom and Australia) by means of day classes.

(2) General adult education, whether in classes or in women's clubs and discussion groups, can help to give an introduction to cultural, social and political issues, so that the mind is stirred to think on a wider range of topics than those of immediate occupational or domestic concern.

(3) Finally, and most important, given the vital part played by women in the early training, upbringing and education of young children, there is need for a practical introduction to the psychology of the child, for explanations of the intellectual, emotional and spiritual needs of the early years and of the ways in which the mother—natural or adopted—can help to meet them.

II. In all these fields considerable progress has been registered of recent years, not least in the countries in process of industrialization.

A. Thus in India a start has been made by the establishment of women's institutes and community centres in a large number of rural areas, together with travelling lecturers, whose task has been to give instruction in making and mending clothes, cooking, food values, dietetics, first aid, prevention of disease and the promotion of health, child training and welfare. Increasing provision is being made at both the primary and secondary stages for the adjustment and flexibility which are essential to the general and technical education of girls. Curricula which in the past were far too closely modelled on those available for boys are being altered to give proper weight to those arts which are essential to the woman's sphere. At the same time women are being trained in increasing numbers for those professions, such as law, medicine and diplomacy, which were once exclusively the province of the male sex.

B. In Turkey, the need has long been felt for teaching girls and women a useful trade, as well as ensuring that as wives and mothers they are more informed and understanding. Provision is now made for this teaching—in girls' institutes in the urban areas, in women's evening trade schools, and in village institutes and centres for older

women in the rural areas. The proper training of those who are to instruct women and girls in technical subjects is provided by the Technical Teachers' Training College for Women in Ankara. Women in Turkey are being increasingly encouraged to take an active role in civic life, while their natural needs and interests in the home and in the care of the growing generation are being nurtured by enlightened guidance.

C. In the more highly industrialized countries, emphasis has been not only on the better training of women as homemakers, but also on the adult education of women in general, whether as formal instruction or as the mutual education that comes from meeting together. Organizations, such as the Women's Clubs in America, the Townswomen's Guilds and Women's Institutes in Great Britain, and similar bodies elsewhere, are making strenuous efforts not only to stimulate women's cultural and civic interests, but also to ensure that the effects of separation from home life by an industrial or commercial job shall not thwart or weaken women's essential contribution to the management and organization of the home.

III. While recognizing that the whole problem of the education of girls and women in a technological society requires far more detailed and expert consideration than it was in a position to give, the Conference nevertheless felt itself on firm ground in making three main proposals:

A. That there should be parity between the education available to girls and women and that available to boys and men. This emphatically does not mean that the methods and curricula should be the same; but both from the standpoint of justice, and from the standpoint of the well-being of a community and of the world at large, women are not only entitled to but need to be given the best instruction a country can afford.

B. That in a number of ways, not all of them educational only, the dual role of women in the modern world requires to be taken into account. The upgrading in the social and professional scale of the "personal" occupations is particularly necessary.

C. That as homemakers, as individual citizens in their own right, and as the most potent influence upon the coming generation, girls and women should be given every facility for continuous education throughout life.

CHAPTER VII

ADMINISTRATIVE MEASURES NECESSARY TO ENSURE A DYNAMIC INTEGRATION OF EDUCATION WITH THE NEEDS OF A CHANGING TECHNOLOGICAL SOCIETY

I. Finally the Conference turned to the all-important question of how the general principles of reorientation indicated in the preceding chapters could be put into practice. Social foresight to secure a better balance between the education provided and the occupations available needs to be made effective by administrative machinery designed for the purpose. In view of the great differences in structure, tradition and organization which exist between the various countries, it was unanimously agreed that no uniform pattern was possible. A useful purpose could, however, be served by exchanging information about existing administrative agencies and about the work that has already been accomplished so that it might be possible to enunciate certain guiding principles without necessarily specifying in detail the mechanism of application.

II. A. The general experience of Brazil, Turkey and India was that whilst the Government and business interests had both been active in recent years in promoting schemes for the development of technical education, neither the trade union movement nor the schools and colleges had yet played a prominent part in shaping the programmes of technical training or in advising on the syllabuses and content of technical education.

(1) Thus, in Brazil, both the "Service of Industrial Apprenticeship" and the "Service of Commercial Apprenticeship" are directly managed by private concerns and administered by the confederations of industry and commerce respectively.

(2) In Turkey, the initiative has lain with the Government, assisted by panels of expert industrial and agricultural managers, who help to approve the main features of the curricula of technical schools.

(3) In India, the Government, assisted by business men and technical experts, has been extremely active at the centre, but local initiative and advice springing from the schools and educational interests themselves has not yet developed to any marked extent.

B. In Australia, co-operation in the administration of technical education has been developed on a much more extensive scale.

(1) On the educational side, advisory councils exist at national, regional and local levels. The national body is composed of representatives of the Government, professional institutions, employers and employees, technical institutes and the relevant examining bodies. The regional councils consist of representatives of local educational authorities, colleges, regional employers' associations, trade union associations and teaching bodies. The local councils are made up of employers and representatives of the technical authorities. Although these bodies are strictly advisory, and the responsibility for putting their advice into practice lies in the last resort with the Central Educational Authority, their value and importance are considerable and they have done much to raise the level of technical education generally.

(2) On the side of industry and labour, the Department of Labour and National Service is the authority dealing with technical education. Through its employment division the Department maintains links with State education departments, with which it co-operates in school counsellor activities, in obtaining and using school-leavers' records and in introducing measures designed to attract school-leavers to make use of the employment service. It also provides vocational guidance services, which issue information pamphlets on occupations and occupational opportunities for school-leavers. Juvenile Employment Officers are encouraged to visit schools, to talk to groups of pupils and to advise individual pupils; they will, on request, arrange industrial visits. At the administrative level the Commonwealth Employment Office is represented on all inter-departmental committees dealing with youth employment and opportunities in industry, whilst in most States there are associated local industrial advisory committees set up by the Government to represent important industrial interests, professional bodies and the teaching staff. The duty of these committees is to consider the composition and adequacy of the courses provided by the technical colleges, and to recommend changes in courses to meet the needs of the industry. The Technical Education Committees have benefited greatly from the sympathetic helpful attitude of the trade unions, the employers of the area and the teachers.

C. (1) In many respects the administrative pattern that has grown up in a highly industrialized country like Great Britain bears a close resemblance to that in operation in the Commonwealth of Australia.

The government departments mainly responsible for education and training in Great Britain are the Ministry of Education and the Ministry of Labour respectively, with some functions falling to the Ministry of Agriculture. The closest possible co-ordination at the national level is ensured by means of cross-representation on such committees as the Central Juvenile Employment Executive of the Ministry of Labour, and the National Advisory Council on Education for Industry and Commerce of the Ministry of Education. This latter

is a representative body comprising employers, employees, university, technical college and local education authority representatives, set up to advise the Minister on major questions of policy regarding technical and commercial education. It is assisted by similarly constituted regional councils which are advisory at the regional level to local education authorities in their areas.

Local advisory committees on industrial needs have likewise been established at the invitation of a large proportion of the technical colleges and institutes. These committees advise on the composition and content of technical courses conducted in the colleges and bring them into line with local industrial needs wherever possible.

In the Ministry of Education itself, the essential unity of technical education with other forms of adult education contributing to the development of the personality of the whole man is emphasized by the grouping of both technical and non technical education under a single division of the Ministry, the Department of Further Education. It is felt that this administrative unity lays emphasis on the indivisibility of work in this field—a principle which may tend to be overlooked in a rapidly developing technological society where the need for improved technical education may, at first sight, seem to be paramount.

(2) A somewhat different administrative pattern has been adopted in Sweden, where the Board of Education administers primary and secondary schools, the Board of Vocational Education administers municipal trade schools, workshop schools, etc. and the Royal Labour Board administers the labour exchange service, vocational guidance and training courses to help workers to change from one trade to another. Co-ordination between these three agencies is ensured by means of cross-representation. A joint commission of the three bodies has recently been formed to work out plans for vocational guidance both in the present school system and in the proposed new system.

(3) In Denmark and the Netherlands, whilst there is no administrative body linking all educational and industrial authorities, the closest possible co-operation exists between government departments. Thus, in the Netherlands, the co-operation of experts from the Research Department of the Ministry of Education, the Central Planning Bureau, the Central Bureau of Statistics and the Ministries of Social and Economic Affairs makes it possible to submit co-ordinated advice to the Minister of Education regarding, for example, the strengthening and stimulation of certain parts of the educational system, the types of school to be enlarged and the new kinds of education to be encouraged. This advice is based on the latest available data on the demand for labour, demographic development, and changes in the economic structure of the country.

(4) In Belgium, industry participates in an advisory capacity on the Council for the Improvement of Technical Education at the national level; furthermore, it is closely associated with local institutes both in

assessing the competence of individual students and in directing their studies. In the sphere of higher technological study, employers' organizations in the engineering, electrical, textile and coal industries, among others, have set up administrative and technical committees to establish standards of professional competence. These standards are being increasingly adopted throughout the technical schools and institutes.

(5) A similar close co-ordination of educational syllabus with technical requirements exists in Switzerland and in France, particularly in the training of apprentices and the adjustment of school programmes to regional needs. In France this is carried out through the *Conseil de Perfectionnement* representing the employers' and workers' associations, the teachers and the local authorities. Nationally, the task of administrative co-ordination is in the hands of the Ministries of Labour and of Education, assisted by special consultative commissions composed of representatives of employers and employees in industry and commerce, who help to work out technical programmes for the schools.

III. Certain principles emerged from the exchange of views which took place at the Conference regarding administrative agencies and methods for ensuring that education becomes more suited to the needs of a changing technological society. Further consideration of these principles by countries may be of value.

A. It appears that real co-ordination and genuine co-operative effort is most nearly achieved where many different agencies—representing, e.g. industry (including both employers and workers), teaching staffs of technical institutes, professional institutions, local authorities and governments—are brought together for consultative purposes; and that development is slower in the long run when administration is concentrated in the hands of any one agency, however effective it may be in itself. This broad principle applies locally, regionally and nationally. Thus, a local technical institute is liable to be less effective in its teaching if it does not possess an active industrial advisory committee, where employers and workers can meet the educationalists to draft syllabuses and curricula which really fulfil local needs. At the national level, while concentration of the whole burden of policy-making and administration in a government office may result in bureaucratic smoothness and efficiency, it may also result in the loss of much useful experience and knowledge. Representatives of industry and the professional institutions should be given an opportunity to advise the Ministries concerned with education, labour and the like, on the most effective methods of reorientating the technical education system so that it shall fulfil the country's needs.

B. Co-operation and co-ordination at local, regional and national levels may take different forms.

(1) The various educational agencies may need to attain closer harmony and a more united purpose.
(2) More needs to be done to promote understanding and knowledge as between Departments of Government responsible for educational and labour affairs.
(3) Industry, including both employers and workers, needs to be brought into closer contact with the local schools and institutions and the various educational authorities.

C. There are four types of educational institutions whose relations with the outside world and with each other need to be developed. These are: schools dealing primarily with general education; secondary schools and junior technical institutes; the higher technical institutes; and the universities.
(1) In schools of general education, for example, much could be gained by closer co-operation between the school, the community and the parents than has been obtained in the past. Particularly in the early years, the education of the child must be the common effort of home and school. Thus, schools may find great benefit in the establishment of "parent-teacher associations"—which provide opportunities for the parents to participate in school life—or of advisory boards composed of parents and other interested members of the community, which may, for instance, give technically trained people the opportunity to advise on workshop activities, even though these activities designedly do not serve a specific occupational purpose but are intended to assist in the development of the whole man.
(2) In the secondary schools, particularly those with a vocational purpose, and in the junior technical institutes, it would seem to be of special importance that industry, labour and professional associations should be invited to participate in the development of the curricula and the setting up of workshops, as well as in other matters where first-hand technical knowledge is needed.
(3) It is particularly important that in technical schools and institutes—which in some countries are administered by the Ministries of Industry, Commerce, Agriculture or Mining rather than the Ministry of Education—should be closely related to other types of educational establishment, so that they are not isolated from the general educational system of the country.
(4) At the level of university and professional training, it is of great importance that teachers and students alike in the technological faculties of universities should be given frequent opportunities of contact with the industrial world, so that they may be kept abreast of modern developments in research and of practical applications in laboratories and industrial plant.

D. As a concrete example of the various administrative principles outlined above, the Conference gave attention to a particular point of contact between industry and the educational world—that

of apprenticeship. In setting up an appropriate system, the following considerations are among those to be borne in mind.

(1) First, since it is "in-employment" education, the training of the apprentice is regulated by the contract between the employer and the trainee, and as such may possibly be less susceptible to organized direction or co-ordination than "in-school" education, which is everywhere more closely subject to public supervision and planning.

(2) Many countries, however, realize that the further development of apprentice training requires an administrative agency to register apprentices, improve standards, supervise training, conduct examinations, and certify the satisfactory completion of an apprenticeship. Such an agency will usually call for the co-operation of industry, labour and the government, if possible locally, regionally and nationally. Training standards, for example, are best developed on a regional or national basis. The Ministry of Labour or of Industry may in many cases take the initiative, but industry, labour and technical associations should all contribute to the advancement of apprenticeship and similar training.

(3) On the other hand, the detailed administration of apprentice training will necessarily rest, in most cases, with local rather than with regional or national agencies. For, while the apprentice contract is concluded between the employer and the trainee, the local apprenticeship agency should have an opportunity to register the contract, to exercise supervision over the progress of training in the workshop and (in co-operation with the educational authorities) to arrange for supplementary education and training in the local technical school or institute on a part-time basis.

(4) The organization of this supplementary education and training for the apprentice is of the very greatest importance. Whilst in some cases individual employers, or associations of employers and labour, finance and administer this supplementary instruction, it is primarily the responsibility of the education authorities. The preparation of the curricula requires the closest possible co-operation between the educational authorities on the one hand and artisans and technicians on the other.

(5) Both in the preparation of these supplementary courses and in the estimation of the appropriate number of apprentices for the various trades, apprentice training should be considered as part of the country's general system of education.

E. Finally, there is the difficult problem of how social foresight —the informed forecasting of broad occupational trends—can be administratively integrated with the network of educational agencies in a country.

(1) Partly by a study of current social and technological developments, partly by international comparison of countries at different stages of industrialization, social scientists are in a position to foresee with a

reasonable degree of accuracy the major lines of occupational development over the coming years. This does not mean that they can predict the numbers required in any particular trade 20 years hence, nor that they can judge in advance the revolutionary effect of a new factor such as atomic power. But they can unquestionably make more enlightened estimates—specially with regard to the broad division between primary, secondary and tertiary occupations—than can those who have no expert skill in this type of work and who are all too often planning rather to avoid the errors of the past than to solve the problems of the future.

(2) The Conference therefore considered that some countries might find it desirable to set up something in the nature of a Central Review Agency, the function of which would be to secure that general and technical education should as far as possible look to the future—the next 40 years when the children now in the schools will be called upon to play their part in life. Failing some administrative machinery of this kind, by which the broad technological and occupational trends may be taken into account, it is highly probable that these trends will be ignored; to the great harm of the individuals so mistrained, to the country thus lacking in foresight, and to the world as a whole.

CONCLUSION

SOME FUNDAMENTAL QUESTIONS WHICH MIGHT USEFULLY BE ADDRESSED TO THE MEMBER STATES OF UNESCO

WITH A VIEW TO PREPARING AN INTERNATIONAL RECOMMENDATION UNDER ARTICLE IV(4) OF THE UNESCO CONSTITUTION

I. The primary purpose of the preceding report, based upon the findings of the Expert Conference on Educational Systems and Modern Technology, is to prepare the way for certain specific questions to be addressed to the Member States of Unesco. It is recognized that these questions need to be considered against the background of the educational situation in each country, and in particular of:

(1) The extent of literacy.

(2) The law, custom, or practice concerning the school-leaving age.

(3) The proportion of children of school age actually receiving general or technical education.

As far as literacy is concerned, it is important to remember that in over half the Member States of Unesco between 30 per cent and 90 per cent of the total population is illiterate. Until this basic handicap has been largely removed, progress towards a system of general and technical education fully suited to meet the needs of a technological society will necessarily be slow. The existence of illiteracy in itself, however, should not be regarded as an insuperable difficulty in the way of initiating vigorous developments in general and technical education.

Similarly, the school-leaving age and the proportion of children receiving education necessarily have a great effect on the whole educational structure, and on the rélation of education to industry. They may indeed largely determine the extent to which effective preparation for working life can be provided through the medium of the schools. In any event, they will obviously affect the type of measures to be taken. If, for example, a comparatively low proportion of young people are in fact enjoying the benefits of full-time schooling or the school-leaving age is low, it may be necessary to plan for a very great expansion of day or evening part-time education in technical colleges and institutes. If, on the contrary, a high proportion of young people are in full-time attendance at secondary schools until the age of 16, 17 or 18, it may be necessary to change the curricula or the teaching method, in order to make the best possible use of the longer period of school life, and so to produce an adaptable, intelligent and

balanced entrant to the world of industry, commerce or the professions. But while it is true that the broad setting varies enormously from country to country, the problem itself is everywhere essentially the same, viz., how to give children and young people the means to cope with the conditions of a technological society, characterized by increasing mechanization and ultra-rapid change.

II. The findings of the Expert Conference on this point may be briefly summarized in seven propositions:
(1) That *organized social foresight* is essential if the educational system of a country is to prepare children for the type of life and work they are likely to encounter.
(2) That a *substantial development of technical education* is required at all levels.
(3) That the *practical content of general education* is now inadequate to meet the needs of the future citizens of a technological society.
(4) That the *cultural content of technical education* is also generally inadequate and calls for special consideration.
(5) That *training for adaptability* is an outstanding requirement in an age of ultra-rapid technological change.
(6) That the *education of girls and women* demands particular attention in view of their dual role as workers and home-makers.
(7) That *improved administrative arrangements* are essential if education is to fulfil its true function in a technological society.

III. It does not follow that all these propositions apply equally to every country; but the Conference considered that, as far as its knowledge extended, they were generally valid for the world as a whole.

The following would therefore appear to be the questions to which the attention of Member States might usefully be drawn:
(1) What measures are (a) actually in operation; (b) in prospect, for the regular estimation of the short term and long term future requirements for trained personnel? (cf. Introduction. Art. I and Ch. I).
(2) What means are (a) actually being used; (b) in prospect, for ensuring that the future requirements for technically trained personnel at all levels shall be met? (cf. Introduction, Art. II and Ch. II).
(3) What means are (a) actually being used; (b) in prospect, for ensuring that general education shall comprise practical instruction of a realistic and contemporary character, appropriate to life in a technological society? (cf. Introduction, Art. III and Ch. III).
(4) What means are (a) actually being used; (b) in prospect, for ensuring that cultural education shall constitute an integral part of the instruction given in technical schools and institutes? (cf. Introduction, Art. IV and Ch. IV).
(5) What means are (a) actually being used; (b) in prospect, for

making technical training sufficiently supple to meet the needs of a rapidly changing technology? (cf. Introduction, Art. V and Ch. V).
(6) What means are (a) actually being used; (b) in prospect, for providing adequate technical and specialized education for girls and women? (cf. Introduction, Art. VI and Ch. VI).
(7) What administrative machinery is (a) actually in operation; (b) in prospect, for securing appropriate adaptation of the educational system as the technological situation evolves? (cf. Introduction, Art. VII and Ch. VII).

IV. In formulating these questions it should again be emphasized that the essential object behind them, as continually reiterated by the Expert Conference, is not to adapt man to technology but technology to man. Too often man has become the slave of the machine. He has to learn to become its master. In the view of the Expert Conference this is one of the principal purposes of education in a technological society; and as such calls for the most earnest attention of the countries of the world, both those where industrialism is highly developed and those whose experience of modern technology is only now beginning. But mastery of the machine is not an end in itself. It is a means to an end: the development of the whole man and of the whole society. Such was the faith of those who formulated these questions and such the spirit in which they are to be understood.

APPENDIX A

PARTICIPANTS IN THE EXPERT CONFERENCE ON EDUCATIONAL SYSTEMS AND MODERN TECHNOLOGY HELD IN UNESCO HOUSE ON 26-30 JUNE 1950

BERNASCONI, MR. G., President of the Centrale d'éducation ouvrière, Berne.

BLADEN, Professor V. W., Director of the Institute of Industrial Relations, University of Toronto.

BOALT, Professor G., Professor of Sociology, University of Stockholm.

BRAY, Mr. F., Senior Government Official in charge of the Further Education Branch, Ministry of Education, London.

CASSAN, Mr. P., Manpower Section, International Labour Office, Geneva.

CLARK, Mr. COLIN, Director, Bureau of Industry, Brisbane; Government Statistician of the Queensland Government, Brisbane.

CLARK, Mr. JOHN, Chief Education and Research Officer, New South Wales Department of Technical Education, Sydney.

DORFMAN, Mr. A., Economic and Social Council, United Nations, Lake Success.

GHOSH, Dr. J. C., Director, Indian Institute of Technology, Ministry of Education, Calcutta.

IDENBURG, Dr. PH. J., Director-General of Statistics, Netherlands Central Bureau of Statistics, The Hague. Accompanied by Mr. J. de Bruijn, Head of the Department of Cultural Statistics, Central Bureau of Statistics.

JOEK, Professor TH., Professor, Copenhagen.

KAHLER, Dr. A., Unesco Special Consultant, Graduate Faculty of Political and Social Science, New School for Social Research, New York.

LIU, Mr. B. A., Head of Statistical Service, Unesco.

LOURENCO Filho, Mr. M., Vice-President of the Brazilian Institute of Education, Science and Culture; Director of the National Department of Education, Rio de Janeiro.

MCGRANAHAN, Mr. D., Economic and Social Council, United Nations, New York.

MARTIN, Mr. P. W., Social Sciences Department, Unesco.

OGBURN, Professor W., Department of Sociology, University of Chicago.

RAGEY, Mr. L., Director, Conservatoire national des arts et métiers, Paris.

SANER, Mr. FERID, Director, Enseignement technique et professionnel, Ministère de l'éducation nationale, Ankara.

SAUVY, Mr. A., Director, Institut national d'études démographiques, Ministère de la population, Paris.

VERCLEYEN, Mr., Inspector General, Enseignement technique, Ministère de l'instruction publique, Brussels.

APPENDIX B

PERCENTAGE DISTRIBUTION OF THE LABOUR FORCE IN THE UNITED STATES BY INDUSTRY AND SERVICE, 1840—1940 [1]

	1840	*1870*	*1880*	*1890*	*1900*	*1910*	*1920*	*1930*	*1940*
	%	%	%	%	%	%	%	%	%
Agriculture, forestry and fishing	77.6	53.5	50.0	43.4	38.2	31.6	27.6	21.9	18.3
Mining		1.4	1.7	1.9	2.4	2.6	2.6	2.0	2.1
Manufacturing and mechanical industries	16.8	15.9	18.2	18.8	20.6	23.8	26.2	24.3	23.9
Construction		4.6	3.9	4.9	4.2	4.7	4.1	4.6	5.3
Trade, transport and communications	4.3	11.0	12.7	14.8	17.3	16.8	17.3	20.4	22.9
Clerical occupations		0.6	0.9	2.0	2.5	4.6	7.3	8.2	9.3
Professional service	1.3	2.6	3.2	3.8	4.1	4.6	5.1	6.7	6.8
Public service		0.7	0.8	0.9	1.0	1.2	1.7	1.8	2.6
Domestic and personal service		9.7	8.8	9.6	9.7	10.1	8.0	10.1	8.8
Total:	100	100	100	100	100	100	100	100	100

[1] Compiled from U.S. Census Data. *Source:* Kahler A. and Hamburger E., *Education for an Industrial Age*, Ithaca and New York, 1948, p. 26.

APPENDIX C

YEARS OF SCHOOLING OF DIFFERENT OCCUPATIONAL CLASSES IN THE U.S.A., AND CLASSIFICATION OF DIFFERENT TYPES OF SCHOOL

Table 1. Median Number of Years' Education of Various Occupational Classes [1]

Date of birth	*Professional and semi-professional*	*Farmers and farm managers*	*Proprietors, managers and officials (non-farm)*	*Clerical, sales and kindred workers*	*Craftsmen, foremen and kindred workers*	*Operatives and kindred workers*	*Personal service workers*	*Farm labourers and foremen*	*Labourers, except farm and mine*
White Males (native born):									
1875-1884	16.0	7.2	8.5	10.3	7.6	7.2	7.5	6.5	7.0
1885-1894	16.0	7.3	9.5	10.5	7.7	7.2	7.7	6.8	7.1
1895-1904	16.0	7.5	11.5	11.5	8.2	7.8	8.1	7.2	7.4
1905-1909	16.0	7.9	11.8	11.8	9.2	8.5	9.2	7.5	7.9
1910-1914	16.0	8.1	12.0	12.1	10.3	9.0	10.3	7.7	8.0
1915-1917				12.0	11.5	10.4	10.6	8.0	9.6
1918-1919						12.2	10.9	8.1	10.0
1920-1921								8.0	9.5
White Females (native born):									
1875-1884	14.0	7.3	9.7	10.9	7.8	7.6	7.7		
1885-1894	14.5	7.6	10.4	11.2	8.0	7.5	7.8		
1895-1904	15.0	7.9	11.5	11.6	7.5	7.7	8.1		
1905-1909	14.9	7.5	11.7	11.6	9.5	8.0	9.3		
1910-1914	14.9	7.4	11.9	11.9	10.1	8.5	10.0		
1915-1917				12.0	11.5	9.5	9.8		
1918-1919						10.0	10.9		

[1] Taken from U.S.A. Census, 1940.

Table 2.

Classification of Different Types of School by Level of Education

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HIGHER EDUCATION

(a) *Degree-granting colleges, universities and higher technical and professional schools*:

Theology,
Law,
Medicine,
Nursing and midwifery (when on level of higher education),
Dentistry,
Pharmacy,
Veterinary science,
Arts or philosophy (philology, literature, history, geography, philosophy, psychology, sociology, archaeology, ethnology, etc.),
Science (mathematics, statistics, astronomy, geology, hydrography, meteorology, biology, physics, chemistry, etc.),
Engineering,
Architecture,
Agriculture (horticulture, agronomy, etc.),
Commerce (accountancy, business administration, etc.),
Journalism,
Senior teacher training schools, including colleges of education,
Higher institutions for fine arts, music, drama, etc.

(b) *Non-degree-granting colleges or schools*:

General educational institutions, e.g. junior colleges, etc.,
Colleges for teacher training,
Other technical and professional schools,
Military colleges for army, navy, air force, police officers, etc.,
Higher institutions of fine arts, music, drama, etc.

SECONDARY EDUCATION

Academic high schools,
Agricultural high schools,
Commercial high schools,
Technical and vocational high schools,
Trade schools for vocational training in agriculture, mining, metal work, glasswork, etc.,

Teacher training institutions (below higher education level),
Schools for nurses (below higher education level),
Schools for fine arts (below higher education level).

PRIMARY EDUCATION

Primary and elementary schools,
Primary divisions of academic secondary schools.

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